

26433 - Fundamentals of Petrogenesis

Información del Plan Docente

| | |
|------------------|----------------------------|
| Academic Year | 2017/18 |
| Faculty / School | 100 - Facultad de Ciencias |
| Degree | 296 - Degree in Geology |
| ECTS | 5.0 |
| Year | 4 |
| Semester | Second semester |
| Subject Type | Optional |
| Module | --- |

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

This optional course is designed to introduce the basic concepts and principles about the mechanisms and processes that lead to the formation of the different rock types, their evolution and relationships at the global-dynamics scale. The study and parametrization of the geochemical signature of these processes are introduced as a basis for simple and complex modelling procedures.

The basic concepts will be developed in lectures and some of the subjects will be studied more in-depth by the students,

26433 - Fundamentals of Petrogenesis

through bibliographic search, synthesis and elaboration of short essays on the selected topics. These essays will be used for grading.

The theoretical concepts will also be used in practical sessions, by means of case-studies and implementation of computer-aided calculation procedures applied to petrogenetic problems.

5.2.Learning tasks

This course comprises four learning activities:

- Lectures (2,3 ECTS credits), developed in two fifty-minutes sessions per week.
- Laboratory practicals (1,4 ECTS credits), developed in seven two-hour sessions.
- Computer lab practicals (0,6 ECTS credits), developed in three two-hour sessions, for geochemical calculations and modelling.
- Field trips (0,7 ECTS credits); two one-day field trips are scheduled during the course.

English-language resources (bibliography and online resources) are to be used along the course both in lectures and practicals. These activities are equivalent to 1 ECTS credit in english language for the students.

5.3.Syllabus

Lectures (2,3 ECTS)

Unit I

1.- Methodology and assessment in studies of igneous petrogenesis (fieldwork and sampling, laboratory and data treatment). Petrology, mineral chemistry and absolute dating. Geochemistry (major and trace elements, isotope systematics). Magmatic affinity. Sources and Modelling of processes (PM, FC, AFC): parameters and selection of the model. Testing of the results and verification in their geodynamical context.

Unit II

2.- The main Large Igneous Provinces (LIP's) in Earth history and their consequences. Definition of LIP's: concept, available data, geodynamic and temporal frame, classifications. The interpretation of LIP's and their consequences on the reconstruction of the mantle-crust system along earth history.

3.- Super-eruptions: concept, mechanisms, products and consequences. Super-eruption vs super-volcano. Case studies: processes in a super-eruption, products, reservoirs and plumbing systems, inactivity intervals and their meaning. Volcano

26433 - Fundamentals of Petrogenesis

monitoring and hazard prevention.

Unit III: Case studies on LIP's

4.- Archean LIP's. Relevant examples and main types: flood basalts, greenstone belts, komatiites and other minor types.

5.- The Siberian platform and its relevance for the Permian-triassic boundary. Evolution of the igneous system: petrology, geochemistry and ages of the events. Petrogenesis of the igneous rocks.

6.- The Karroo province (S. Africa) and its geological significance. Geodynamic significance and tectono-magmatic evolution. Petrology, geochemistry and petrogenetic models for the different stages. Environmental effects.

7.- The Deccan LIP (S. India) and its geological significance. Geodynamic significance and tectono-magmatic evolution. Petrology, geochemistry and petrogenetic models for the different stages. Environmental effects.

8.- The Columbia river LIP (W of the EEUU). Extension, volume and ages of its different emplacement stages. Evolution of the magmatic reservoirs. Petrology, geochemistry and petrogenesis of the products. Environmental effects.

9.- The Ethiopian Neogene volcanic region. Petrology, geochemistry and age of the products in their different evolutive stages.

10.- Igneous processes in the oceans. Recent data on the oceanic volcanism in the Atlantic, Pacific and Indian oceans. Seismic data, geomorphology, lithologies, hydrothermalism and mineral deposits. Case studies of the studies in drill-cores. Petrogenesis of ocean volcanism and the oceanic mantle-crust system.

Unit IV

11.- The Cabo Ortegal complex (NW of Spain). Geological frame. Petrology and geochemistry of igneous and metamorphic rocks and their implications on the geology of ophiolite complexes. Relationships with other ophiolitic complexes (Betic cordillera and other regions).

12.- The Cabo de Gata volcanic region. Geological setting. Ages and evolution of the volcanic events. Petrology and geochemistry of the products. Relationships with other areas in the surroundings (Morocco and Alboran Sea)

Practical sessions

Laboratory (1,4 ECTS)

Seven two-hour sessions, focused on the petrographic analysis and petrogenetic interpretations of metamorphic and igneous rocks, applying the theoretical concepts previously explained in lectures.

Geochemical calculation (0,6 ECTS)

26433 - Fundamentals of Petrogenesis

Three two-hour sessions, coordinated with the laboratory sessions in which the students will apply general of specific software to the resolution of geochemical calculations.

Field practicals (0,7 ECTS)

Two all-day field trips are scheduled in this course, each one related to one of the units of the program. The goals of these field trips are the identification of the relationships amongst different rock units, the recognition of petrogenetic information in the field and the acquisition of the proper methodology to be applied in each case.

5.4.Course planning and calendar

Planning of learning activities and scheduling of assessment dates

The scheduling of theoretical and practical classes and dates for examinations are published in the website of the Science Faculty (<https://ciencias.unizar.es/calendario-y-horarios>).

| Week/Activity | 1 | 2 | 3 | 4 |
|---------------|---|---|---|---|
| 1 | x | | | |
| 2 | x | | | |
| 3 | x | x | | |
| 4 | x | x | | |
| 5 | x | | x | x |
| 6 | x | x | | |
| 7 | x | x | | |
| 8 | x | | x | |
| 9 | x | x | | |
| 10 | x | x | | |
| 11 | x | | x | x |
| 12 | x | x | | |

| | | | | |
|----|--|--|--|--|
| 13 | | | | |
|----|--|--|--|--|

1: Theoretical sessions. 2: Laboratory sessions. 3: Computer/problems. 4: Fieldwork.

5.5. Bibliography and recommended resources

- BB** Best, Myron G.. Igneous and metamorphic petrology / Myron G. Best . - 2nd ed. Malden : Blackwell, cop. 2003
- BB** Boudreau, Bernard P.. Diagenetic models and their implementation : modelling transport and reactions in aquatic sediments / Bernard P. Boudreau Berlin [etc.] : Springer, cop. 1997
- BB** Giles, Melvyn R.. Diagenesis : a quantitative perspective : implications for basin modelling and rock property prediction / by Melvyn R. Giles Dordrecht [etc.] : Kluwer Academic, cop. 1997.
- BB** Hibbard, Malcolm J.. Petrography to petrogenesis / M. J. Hibbard Englewood Clifs (New Jersey) : Prentice Hall, 1995
- BB** Larsen, G. & Chilingar, G. V.. Diagenesis in Sediments and Sedimentary Rocks. Elsevier. 1979
- BB** Metamorphic rocks : a classification and glossary of terms : recommendations of the International Union of Geological Sciences Subcommittee on the Systematics of Metamorphic Rocks / editors D. Fettes and J. Desmons ; contributing authors P. Árkai ... [et al.]. . - 1st published Cambridge [etc.] : Cambridge University Press, 2007
- BB** Morse, John W.. Geochemistry of sedimentology carbonates / John W. Morse, Fred T. Mackenzie Amsterdam [etc.] : Elsevier, 1990
- BB** Parker, A. and Sellwood, B.W.. Quantitative Diagenesis: Recent

26433 - Fundamentals of Petrogenesis

Developments and Applications to
Reservoir Geology. Kluwer. 1995

- BB** Parker, A. and Sellwood, B.W.. Sediment Diagenesis. Kluwer. 1983
- BB** Scholle, P.A. and Schluger, P.R.. Aspects of Diagenesis. S.E.M.P. 1979
- BB** Spear, Frank S.. Metamorphic phase equilibria and pressure-temperature-time paths / Frank S. Spear . - [2nd print., corrected] Washington, DC : Mineralogical Society of America, 1995
- BB** Tucker, Maurice E.. Carbonate sedimentology / Maurice E. Tucker, V. Paul Wright ; with a chapter by J.A.D. Dickson . - 1st ed., repr. Oxford [etc.] : Blackwell Scientific Publications, 1994
- BB** Winter, John D.. An introduction to igneous and metamorphic petrology / John D. Winter. Upper Saddle River (New Jersey) : Prentice Hall , cop. 2001.
- BB** Yardley, Bruce W.D.. An introduction to metamorphic petrology / Bruce W.D. Yardley . - [1st ed., repr.] Harlow, Essex : Longman Scientific & Technical, 1993