

PETROGENESIS AND TECTONICS - COURSE DESCRIPTION

1. GENERAL INFORMATION

This course is worth 15 ECTS credits at the advanced undergraduate level and will be in English. The course runs through periods 5 and 6 of the spring term.

2. INSTRUCTOR INFORMATION

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3. PRE-REQUISITES

First year ground course (30 hp) & Mineralogy & Petrology (15 hp).

4. COURSE CONTENTS

This course aims to provide an overview of the processes important in the formation of igneous and metamorphic rocks. Lectures, laboratories, and field work will provide the theoretical and physiochemical basis behind magmatic and metamorphic petrogenesis within a plate tectonic framework. Concepts related to modern analytical techniques, geochemical data generation and its interpretation will be introduced. In addition, an excursion to the Island of Mull (Scotland, UK) during the course will provide hands-on experience linking theory (lectures) to practicals (labs.) via field observations. Students will leave the course with a firm understanding of magmatic and metamorphic processes.

5. COURSE FORMAT

The course is equivalent to a full-time study load for a nine week period. Teaching is conducted through lectures, laboratories, seminars, and field work. Seminars will include reading and discussion, as well as presentation of written and oral summaries.

6. LEARNING OUTCOMES

After completion of this course, students should be able to:

- Identify the key physical processes associated with the formation of igneous and metamorphic rocks, and metamorphism within a plate tectonic framework
- Specify how the composition of magma and style of metamorphism are controlled by plate tectonic environment
- Outline the critical factors associated with the formation and evolution of primary magmas
- Apply knowledge of geochemical processes to define the role of continental crust in the evolution of magmas
- Describe and interpret geochemical data within the context of melt genesis
- Outline the critical factors associated with the formation of metamorphic rocks
- Outline the relationship between metamorphism, fluid flow, formation of metamorphic fabrics, radiometric ages and PTt paths
- Link PTt paths to the tectonic environment
- Use a petrographic microscope to constrain the evolution of igneous and metamorphic environments

7. REQUIRED TEXTS

An Introduction to Igneous & Metamorphic Petrology (2001) by J.D. Winter, Prentice Hall, International edition (paper back), ISBN 0-321-68132-0

Principles of Igneous and Metamorphic Petrology (2009) Philpotts, A.R. & Ague, J.J. Principles of igneous and metamorphic petrology, 2nd edition, Cambridge University Press, ISBN-10: 0521880068 | ISBN-13: 978-0521880060 | Edition: 2nd

8. COURSE ASSESSMENT AND EXAMINATION

The course is designed to provide an introduction to the theory behind igneous and metamorphic petrogenesis within a plate tectonic framework. The course therefore requires:

- Reading of course literature.
- Completing daily laboratory assignments. The laboratories are linked to lectures and reading assignments, and are specifically designed to relate theoretical to applied knowledge. Each laboratory requires completion of a written report.
- Student-lead presentation. Each student/team of students will (co)lead a presentation and discussion integrating the combined aspects of igneous, metamorphism, and structural evolution for a specific tectonic environment. Several articles will form the basis of this presentation and will be selected with feedback from the course instructors. A successful student presentation includes providing a short summary of the papers, summarizing the major points, and linking this material to theoretical concepts.
- Field excursion. The field excursion is an important part of the course, linking theory with observations. Participation is required and daily quizzes will assess your observational skills and ability to synthesize.
- Completion of all exams.

The final grade will be based on the following:

Student presentation 10% - the oral presentation summarizing a specific tectonic setting will be assessed with group and instructor feedback. The student presentation requires i) a written summary (1 A4 page maximum) of the articles used due at the beginning of the presentation, ii) a presentation which coherently integrates the igneous, metamorphic, and structural evolution of a specific tectonic setting, and iii) a demonstrated knowledge and comprehension of the reading assignments via your presentation and direct queries. A point system will be used.

Laboratories 40% - performance in the laboratory will result in a written product which should demonstrate your understanding and successful completion of the exercises. A point system will be used.

Final exam 50% - there will be a final exam at the end of each moment. A point system will be used.

The Bologna grading scheme will be applied:

A (90-100%) = Excellent. To achieve this grade the student should be able to accurately account for course content, understand the theory behind, and identify the geochemical controls associated with igneous and metamorphic petrogenesis. The student should be able to use the course material to define the *major* tectonic environments through the evaluation of geochemical data, and to provide an insightful summary of the major tectonic settings with well-documented supporting evidence.

C (70-79%) = Good. To achieve this grade the student should be able to accurately account for course content, understand the theory behind, and identify *some* of the geochemical controls

associated with igneous and metamorphic petrogenesis. The student should be able to use the course material to define *some* tectonic environments through the evaluation of *most* types of geochemical data, and to provide a summary of these tectonic settings with documented supporting evidence.

E (50-59%) = Sufficient. To achieve this grade the student should be able to accurately account for course content, understand the theory behind, and identify *some* of the geochemical controls associated with igneous and metamorphic petrogenesis. The student should be able to use the course material to define *some* tectonic environments through the evaluation of *some* types of geochemical data.

Fx (40-49%) = Insufficient. To achieve this grade the student should be able to accurately account for course content. This grade is given when there is a clear lack in understanding the theory behind, and the geochemical controls of, igneous and metamorphic petrogenesis. The student has not demonstrated the ability to define tectonic environments through the evaluation of geochemical data, or to provide a summary of these tectonic settings with supporting evidence.

F (<40%) = Fail. This grade is given when the student cannot account for course content and when the work provides an unfocused, limited, and irrelevant understanding of the theory behind, and the geochemical controls associated with, igneous and metamorphic petrogenesis.

E is needed to pass the course. Fx indicates that the student be offered the opportunity to upgrade his/her exam in order to achieve at least grade E. Re-examination will occur within 2 months of the exam or when the course is next offered. A student with E is not entitled to another examination to raise his/her grade. Students who receive grade Fx or F on exams twice from the same examiner can request to be evaluated by another examiner. Such a request should be sent to the Director of Studies.