UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Petrography

**2021-2-E3401Q014**

## Aims

The course of Petrography (12 CFU) provides the fundamentals to understandi the origin and evolution of magmatic and metamorphic rocks. The aims of the course include:

- To understand the processes that are responsible for forming igneous and metamorphic rocks and the tectonic settings where they occur.

- To understand how the chemical composition, structure, and textures of igneous and metamorphic rocks can be used to interpret past and present geologic processes in an area.

- To learn how to obtain, use, and interpret thermodynamic and geochemical data to understand the origin and evolution of igneous and metamorphic rocks.

- To learn how to classify (mineralogy and microstructures igneous and metamorphic rocks under the microscope.

-To learn the fundamantals of fieldwork and sampling of igneous and metamorphic rocks.

## Contents

Field relationships of magmatic rocks. Classification. Introduction to thermodynamics. Magma origin, crystallization, and evolution under equilibrium conditions and out-of-equilibrium. Petrogenetic environments. Metamorphism and Metamorphic Rocks.

## Detailed program

Classification of igneous rocks, with emphasis on the role of crystallization processes.

Phase petrology and the phase rule to study the evolution of igneous rocks magmatic evolution. Binary, and ternary phase diagrams are used to interpret igneous processes, such as, partial melting, crystallisation, zoning, and immiscibility.

Magma chamber processes with emphasis on differentiation processes. Mechanisms of ascent of magmas from the mantle and is stored in the crust with emphasis on the role of active tectonics.

Mantle melting processes to define the genesis of basaltic magmas with distinctive geochemical characteristics in different geodynamic settings.

Major (and trace) elements systematics of magma series to investigate petrogenetic processes.

Analysis of the progressive nature of metamorphism concentrating on metamorphic agents, protholiths and type of metamorphism.

Classification structures and textures of metamorphic rocks with emphasis on the processes of deformation and recrystallization (i.e., stable mineral assemblages). Undertanding of the main metamorphic reactions and reaction mechanisms.

Metamorphic facies: understanding of how the mineralogy of metamorphic rocks corresponds to P-T gradients and protoliths (metamorphism of politic sediments, Mafic rocks and Calcareous rocks).

## Prerequisites

Students are expected to have attended courses of Mathematics, Physics, Chemistry and Mineralogy.

## Teaching form

The Petrography course is divided into two modules: General Petrography (6 CFU) and Petrography Laboratory (6 CFU).

The General Petrography module is organized in 42 hours of lectures on petrology and petrogenesis of igneous and metamorphic rocks. Participation to class lectures is recommended. The module of the Petrography Laboratory is organized as: 7 hours of lectures on the optical propeties of main mineral phases (1 CFU), 48 hours of laboratory classes on the recognition and description under the microscope of igneous and metamorphic rocks (4 CFU) and 10 hours of excursion on the field (1 CFU). Attendance at the laboratory classes is mandatory for at least 70% of the total. Participation in the excursion is mandatory, if there are no physical impediments. Support for practice activities is provided during tutoring hours.

In the period of recurrence of COVID-19 or coronavirus precautionary measures, I will adjust the course organization partially face-to-face, and/or online or blended teaching)

## Textbook and teaching resource

Winter J.D.: “An Introduction to Igneous and Metamorphic Petrology”, 1st or 2nd edition, Prentice Hall, New Jersey.

Peccerillo A. e Perugini D. (2003) Introduzione alla petrografia ottica. Edizioni Morlacchi.

All slides presented will be available on the e-learning platforms (http://elearning.unimib.it/)

Further readings:

Phillpotts A.R. & Ague J.J.: Principles of igneous and metamorphic petrology – 2nd ed. Cambridge.

Deer W.A., Howie R.A. e Zussman J. Introduzione ai minerali che costituiscono le rocce. Edizioni Zanichelli.

## Semester

Second Semester (March -June)

## Assessment method

There are 6 exam sessions, whose dates are announced at the beginning of the academic year. The exam is divided into 2 parts: 1. microscopy laboratory - evaluation in merit classes (A, B, C, D); 2. Written examination on

the theoretical part (General Petrography) with a score in thirtieths. The passing of the laboratory test is preliminary to participation in the test on the theoretical part.

1. Microscopy laboratory test (5 CFU) - The student must demonstrate to be able to write a report aimed at the optical characterization (classification, mineralogy and microstructural characters) of an igneous rock and a metamorphic rock chosen among those studied during the laboratory classes. 3 hours are foreseen for this test. The possibility of an intermediate (exemption) test during the laboratory classes is foreseen.

2. Written test on the theoretical part (6 CFU) - The student must demonstrate to be able to deal with the main topics addressed during the lectures of the General Petrography module. The test consists of 5 open questions to be answered in 3 hours.

The final evaluation, in thirtieths, is weighted based on the results of the 2 tests.

## Office hours

Monday from 2pm to 6 pm