UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Petrology

**2627-3-E3401Q014-E3401Q047M**

## Aims

The Petrography course (12 ECTS) is aimed at understanding the petrogenetic processes that govern the formation and evolution of igneous and metamorphic rocks within major geodynamic settings. The course provides the theoretical and methodological foundations needed to analyse the chemical and mineralogical composition, microstructures, and textures of rocks, interpreting them in relation to physicochemical conditions and geological context.

Through the integration of petrographic, geochemical, and thermodynamic data, students acquire the ability to reconstruct processes such as partial melting, crystallization and differentiation, and mineralogical transformations through phase reactions. Laboratory and field activities include optical microscopy of rock thin sections and the observation of igneous and metamorphic outcrops, aimed at developing practical skills in rock description, classification, and interpretation within their geological context.

The competencies acquired enable students to integrate observations and data for the interpretation of geological processes, providing a solid foundation for advanced studies in Earth Sciences and for the critical reading of the geological record through rock analysis.

## 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 24 lessons of 2 hours, delivered didactics in person, on petrology and petrogenesis of igneous and metamorphic rocks. Participation to class lectures is recommended. The module of the Petrography Laboratory is organized as: 48 hours of interactive teaching on the recognition and description under the microscope of igneous and metamorphic rocks in person (4 CFU) and 20 hours of excursion on the field (interactive teaching). Attendance at the interactive teaching is mandatory for at least 75% of the total. Participation in the excursion is mandatory, if there are no physical impediments. Support for practice activities is provided during tutoring hours.

## Textbook and teaching resource

Winter J.D.: “An Introduction to Igneous and Metamorphic Petrology”, 1?? or 2?? 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 (

Further readings:

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

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

## Semester

First Semester

## 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 (6 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 12 open questions to be answered in 1 hour.

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

## Office hours

Monday from 2pm to 6 pm

## Sustainable Development Goals

CLIMATE ACTION