UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Introduction To Petrography

**2627-1-E3402Q006-E3402Q00602**

## Aims

Aim of the "*Introduction to Petrography*" class is to give a general understanding of the main geological processes that occurred during the Earth evolution, with emphasis on rock petrogenesis. During the practical activity (Rock Lab), students will acquire the basic skills and the ability to characterise the rock forming minerals, the texture and classify the most representative lithologies.

## Contents

*LECTURES* (4 CFU):
- The Earth system
- Principles of Mineralogy
- Igneous rocks and their formation
- Volcanoes as geosystems
- Surface processes of the rock cycle
- Sedimentary rocks
- Metamorphism
- Types of metamorphism and geological environments

*PRACTICALS ROCKS DESCRIPTION* (2 CFU):
- Main rock forming minerals
- Textures and rock classification

## Detailed program

*LECTURES* (3.5 CFU)
The Earth system: geological processes space-time; age of the Earth; reconstructing the Earth; meteorites classification; average density of the Earth interior; density and pressure gradient.
Early history of the Earth: differentiation of the Earth; differentiation and geothermal gradient.
Principles of Mineralogy: definition of mineral; atomic and ionic radii; the coordination number; what controls ionic package in the mineral structures; chemical minerals grouping; silicates; how crystals form; atomic substitutions; polymorphism and isomorphism; minerals and mantle discontinuities.
Igneous rocks and their formation: volcanic and plutonic rocks; chemical and mineralogical composition of igneous rocks; melting of the mantle and magma production; physical properties of magmas: density and viscosity; melts rising in the mantle; magmatic processes; formation of the magma chamber; cooling and processes of magma differentiation; igneous forms; igneous rocks and tectonic environment.
Classification of intrusive bodies.
Volcanoes as geosystems: lavas and pyroclastic deposits; magmatic gas exsolution and explosive volcanism; pyroclastic deposits; eruption types and volcanoes; global volcanism mapping.
Surface processes of the rock cycle: physical anche chemical weathering; formation of sediments; transport of sediment; laminar and turbulent flow; sedimentary structures; turbidites; sedimentation in fluvial delta.
Sedimentary rocks: stratification in sediments and sedimentary rocks; deposition environments, climate e tectonic processes; from a sediment to a rock; sedimentary rocks and deposition environment; carbonatic rocks; carbonate compensation depth.
Metamorphism: the role of temperature, pressure and fluids; what is a metamorphic reaction; minerals and their transformation at high temperature and/or pressure; metamorphic gradient.
Metamorphism and geological environment: contact metamorphism; subduction metamorphism; regional metamorphism; facies and metamorphic grade.

*PRACTICALS ROCKS DESCRIPTION (2 CFU):
The main rock-forming minerals: quartz, plagioclase, alkali feldspars, sanidine, leucite, biotite, hornblende and tremolite, orthopyroxene, diopside-augite ane omphacite, olivine, muscovite, garnet, staurolite, albite.
Igneous rocks: texture, structure and nomenclature; Streckeisen diagram; detailed description of granite, granodiorite, tonalite, syentite, gabbro, diorite, rhyolite, trachyte, andesite, basalt, tephrite, phonolite.
Sedimentary rocks: texture, stucture and nomenclature; detailed description of conglomerate, breccia, sandstone, grainstone, wackestone, mudstone, dolomite, travertine, gypsum.
Metamorphic rocks: texture, structure and nomenclature; metamorphic conditions, structure and index mineral; detailed description of micaschist, orthogneiss and paragneiss, prasinite,, amphibolite, granulite, eclogite and migmatite.

*FIELD ACTIVITY (0.5 CFU)*
Field characterisation of the main structures and lithologies of magmatic and metamorphic rocks of the Southalpine basement.

## Prerequisites

Having completed the Field Safety Course

## Teaching form

The "*Introduction to Petrography*" class consists of a combined learning approach based on 14 two-hour lectures, in person, Delivered Didactics, 12 two-hour practical classes, in person, Interactive Teaching and 1 six-hour field activities, in person, Interactive Teaching, in the summer season. Lectures usually run between March and mid-April, whereas the practical activity lasts the entire first semester (from March to June). Lectures attendance is not

mandatory, but highly recommended. Attendance at the Rock Lab is required for 75% of total (students have to sign in).

Any doubts on lectures and practical activity, as well as on available e-material, can be clarified with the lecturer and during the tutoring.

## Textbook and teaching resource

All teaching material is available on the e-learning platform (http://elearning.unimib.it/) along with some recorded lectures.

"?Understanding Earth"
John Grotzinger; Thomas H. Jordan; Frank Press; Raymond Siever

Further reading:

"Principles of Igneous and Metamorphic Petrology"
2nd Edition[ - Anthony Philpott]

## Semester

Second semester (March - June)

## Assessment method

To assess the learning outcomes of the Principles of Geology course, 7 exam sessions are scheduled each academic year, with dates announced at the beginning of the Academic Year. The exam consists of three components, each graded on a scale of 30 points. Passing each component is required to proceed to the next one. The three components must be completed in the following order:

1. **Cartography Test** (2 CFU) - written test based on the exercises from the Introduction to Geology module. Students must plot the intersection of a geological boundary with the topography based on its orientation, draw a geological cross-section (from a simplified geological map), and answer questions about geological maps. This test takes place approximately one week before the Rock Identification oral exam and the Theoretical Part written exam. Dates are communicated to all students via email by the instructor. A score of ? 18/30 remains valid for all subsequent exam sessions **within the same calendar year.**

2. **Rock Lab Test** (2 CFU) – oral exam based on the exercises from the Introduction to Petrography module. Students must demonstrate the ability to identify the main rock-forming minerals (sedimentary, igneous, and metamorphic), use appropriate terminology to describe textures, indicate the rock-forming environment, and classify three rocks selected from those analyzed during the exercises. This exam takes place on the same day as the Theoretical Part written exam.

3. **Final Test** (3.5 + 3.5 CFU) – written test based on the lectures from both modules: Introduction to Geology and Introduction to Petrography. The test consists of 5 questions: 2 open-ended and 3 short-answer questions, to be completed in 2 hours. Open-ended questions require a well-articulated description using appropriate terminology of

key concepts and their cross-cutting relationships. Short-answer questions require a focused discussion on the specific topic.

**The Rock Identification oral exam and Theoretical Part written exam are held on the same day, corresponding with the scheduled exam session.**

If a student obtains a score of ? 23/30 in the Rock Identification exam but does not pass the Theoretical Part exam, they are allowed to retake only the Theoretical Part **once, during the following exam session.**

The final grade for the Principles of Geology course is calculated as a weighted average of the three components, each graded out of 30, and includes a brief oral report (0.5 ECTS) on the field trip, presented during the Rock Identification exam or submitted as a field notebook. Students must also demonstrate proficiency in using a geological compass.

## Office hours

Every day by appointment. Contact the teacher (nadia.malaspina@unimib.it) by the student e-mail address (.....@campus.unimib.it).

## Sustainable Development Goals

CLIMATE ACTION | LIFE ON LAND