UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Introduction To Petrography

2021-1-E3401Q039-E3401Q046M

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 identify and classify the most representative lithologies.

Contents

LECTURES (4 CFU):
- The Earth system
- Early history of the Earth
- Principles of Mineralogy
- Plate tectonics
- 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 (4 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: formation of the Solar System; Earth accretion and the Moon; elements of the Solar System; differentiation of the Earth; differentiation dna geothermal gradient; from magma ocean to the atmosphere; elements and Goldschmidt periodic table; from the Great Oxygenation Event to the present atmosphere.
Principles of Mineralogy: definition of mineral; atoms structure; chemical reactions; 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.
Plate tectonics: Earth cooling and plate tectonics; convergent and divergent plate boundaries; plate tectonics and origin of the rocks.
Igneous rocks and their formation: volcanic and plutonic rocks; chemical and mineralogical composition of igneous rocks; melting of the mantle and magma production; proprietà fisiche dei magmi: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.
Volcanoes as geosystems: lavas and pyroclastic deposits; magmatic gas exsolution and explosive volcanism; pyroclastic deposits; eruption types and volcanoes; volcanism and itneraction with other geosystems; global volcanism mapping.
Surface processes of the rock cycle: physical anche chemical weathering; formation of sediments; transport of sediment; laminar and turbulent flow; suspended load transport; 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, monzonite, 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 slate, phyllite, micaschist, orthogneiss, amphibolite, granulite, eclogite.

Prerequisites

None

Teaching form

The “*Introduction to Petrography*” class consists of a combined learning approach based on *Lectures* (28 hours in total), *Practical Activity* (Rock Lab, 24 hours in total) and one day of campus abroad in the fall season. Lectures usually run between October and mid-November, whereas the practical activity lasts the entire first semester (from October to January). Lectures attendance is not mandatory, but highly recommended. Attendance at the Rock Lab is required for 75% of total (students have to sign in).

During Covid-19 emergency part of the lectures will be given in the presence of the lecturer at the University institute, whereas the rest of the course will be video-recorded.

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/)

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

Further reading:

"Principles of Igneous and Metamorphic Petrology"
2nd Edition - Anthony Philpott; Jay Ague

Semester

First semester (October - January)

Assessment method

Seven exam sessions of the *Principles of Geology* course are scheduled at the beginning of the Academic Year. Students are evaluated on three tests in this course. Each test has an evaluation in thirtieths. A positive assessment of each test is required to sit for the next one. The three tests have to take as follows:

1. **Cartography Test** (2 CFU) - written examination, related to the module of "Introduction to Geology". The student will have to: draw a topographic profile, a drainage basin and the intersection of a geological surface with the topography; calculate the coordinates of a point on the map, draw a geological section (from a simplified geological map) and answer 9 questions about cartography. This examination will take place approximately one week before the oral examination on Rock Recognition and of the written examination related to the Theoretical Part. The dates will be communicated from the professor to all students by e-mail. A rating ? 18/30 is valid for all subsequent dates of examination.

2. **Rock Lab Test** (2 CFU) – oral examination about the Practical Activity of "*Introduction to Petrography*". Students have to identify the main rock-forming minerals, to describe with correct terminology rock textures and structures, and to classify two rocks among those analyzed. This oral examination has to be taken on the same day of the Final Test. If students do not pass the Final Test, a grade ? 25/30 in Rock Lab test shall be considered valid only for the next exam session.

3. **Final Test** (4 + 4 CFU) – written examination about both classes of "*Introduction to Geology*" and "*Introduction to Petrography*". This test consists of five questions: two long and three short essay questions. The long essay questions require that students are able to neatly and clearly describe with correct terminology the key-concepts relevant to the topic, as well as all related minor issues. The short essay questions require a clear and concise response focused on the subjects.

The final grade of the *Principles of Geology* exam is calculated on the weighted average of the three tests.

No Mid-semester examinations are expected.

Office hours

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