UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Laboratorio di Petrografia

2526-3-E3401Q014-E3401Q048M

Aims

The Petrography Laboratory Module (6 ECTS) is designed to provide students with fundamental knowledge on the genesis and evolution of magmatic and metamorphic rocks, with the following objectives:

- to acquire optical microscopy skills necessary for the mineralogical and microstructural characterization of igneous and metamorphic rocks;
- to learn basic techniques for the field analysis of igneous and metamorphic rock outcrops.

Contents

Description and classification of igneous and metamorphic rocks, with particular emphasis on microstructural characterization; optical microscopy identification of the main igneous and metamorphic minerals; and petrogenetic interpretation of the examined samples.
Field activities include the structural and petrographic study of igneous and metamorphic rocks, with a focus on the relationship between petrogenesis and deformation.

Detailed program

Introduction to petrographic optics, optical properties of minerals, mafic and sialic minerals.

Optical microscope characterisation of olivine, clinopyroxene and orthopyroxene in peridotites and olivine gabbros.

Optical microscope characterisation of amphibole and biotite and chlorite as an alteration of biotite in andestites and granites.

Optical microscope recognition of quartz and alkali feldspar in granites.

Optical microscope recognition of plagioclase, variation of birefringence and refraction index as the calcium content increases, direct/inverse/continuous/discontinuous/oscillatory zoning.

Classification principles of plutonic magmatic rocks and ternary diagrams (QAPF, diagrams for mafic and ultramafic rocks). Definition of isotropic vs. anisotropic structure, color index, grain, crystallization sequence. Modal relationships between phases and recalculation to classify the rock. Identification and optical characteristics of white mica in granites.

Optical microscope recognition and classification of: granodiorite, tonalite and quartz-monzodiorite. Concept of myrmekites and poikilocrystals.

Optical microscope recognition and classification of: syenite, monzonite, diorite and gabbro. Structure, grain, color index; main constituents with related optical characteristics and accessories (opaque, epidote and titanite). Plagioclase composition.

Classification principles of volcanic magmatic rocks. Concept of phenocrysts and glomerocrystals, proficiency index and ground mass. Concept of phenocrystal/groundmass disequilibrium indicates by microstructures such as opaque rims and corrosion loops. Application in the description and classification of andesite and basalts. Identification of the glass in the ground mass. Concept of ophitic and amygdalar structure in a basalt. Identification and optical characteristics of carbonate and ilmenite.

Optical microscope recognition and classification of latite and trachyte. Concept of devitrification index microstructures in the groundmass, such as spherulites.

Optical microscope recognition and classification of dacite and rhyolite. Concept of microstructures indicative of devitrification in the ground mass, such as spherulites and ignimbritic/axiolitic microstructures.

Brief introduction on feldspathoids and application in the observation of a hawyna undersaturated rock. Review with observation of an unknown thin section and its description and classification.

Introduction to metamorphism: optical microscope recognition of biotite, chlorite and epidote and microstructures in greenschist and amphibolitic orthogneiss facies.

Optical microscope recognition of albite, actinolite/tremolite amphibole and microstructures in greenschist facies mafic rocks.

Optical microscope recognition of hornblende, plagioclase, titanite, microstructures and phase relationships in mafic rocks in amphibolitic facies.

Optical microscope recognition of brown hornblende, plagioclase, clinopyroxene, orthopyroxene and granoblastic microstructure of mafic rocks in granulitic facies. Breakdown reaction of the amphibole.

Optical microscope recognition of eclogitic associations, garnet, omphacite, phengite, glaucophane and metamorphic reactions in a mafic system at the greenschist - blueschist - eclogite facies transition.

Optical microscope recognition of porphyroblastic, chlorite, muscovite, garnet and chloritoid microstructures, blastesis-strain ratio in metapelitic rocks in the chlorite zone.

Microscopic recognition of syn- and post-kinematic porphyroblasts. Blast-strain ratios in garnet micaschist, kyanite paragneiss, garnet and staurolite.

Optical microscope recognition of sillimanite and microstructures of high-grade metapelites. Metamorphic reactions involving muscovite and sillimanite and partial melting processes.

Prerequisites

Students are required to have attended courses in Mathematics, Physics, and Chemistry, and to have passed the exams in Principles of Geology and Mineralogy.

Teaching form

The module Laboratory of Petrography is organised as:

- 24 two-hours practical activities in person, Interacttive Teaching, for a total of 48 hours of laboratory classes with optical microscope on the recognition and description of igneous and metamorphic rocks (4 CFU)
- 2 days of ten-hours field work (Campus Abroad) in person, Interactive Teaching, for a total of 20 hours (2 CFU).
  Attendance at the laboratory classes is mandatory for at least 75% of the total. Participation in the excursion is mandatory, if there are no physical impediments and will require the preparation of a report which will be evaluated. Support for practice activities is provided during tutoring hours.

Textbook and teaching resource

“Introduzione alla Petrografia ottica” Peccerillo A, Perugini, D. – Morlacchi Editore, Perugia (2003)

Suggested: “An Introduction to the Rock-Forming Minerals” Deer W.A., Howie R.A., Zussman - Mineralogical Society of Great Britain and Ireland

All slides presented will be available on the e-learning platform along with some recorded lectures

Semester

Firsy Semester (October - January)

Assessment method

To pass the laboratory of petrography the student must demonstrate to be able to write a report aimed at characterizing (classification, mineralogy and microstructural characters) with the optical microscope an igneous rock and a metamorphic rock chosen among those studied during the laboratory classes. 3 hours are foreseen for this test.
There is the possibility of two intermediate tests (one for igneous rocks and one for metamorphic rocks) during the practical sessions. The intermediate tests are reserved exclusively for **students enrolled in the current year and who have attended 75% of the laboratory sessions**. For students who are not enrolled in the current year, this applies only if they attended the laboratory **for the first time** in the year it is held.

Additionally, the student must provide a written report aimed at the mesoscale characterization of igneous and metamorphic rocks studied during the 20 hours of field excursions. The evaluation is conducted in merit-based grades (A, B, C, D), and a weighted average will be calculated, taking into account the credits from laboratory activities and fieldwork activities.

Office hours

Every day by appointment. Contact the Professors (nadia.malaspina@unimib.it – rosario.esposito@unimib.it) using the email ……@campus.unimib.it

Sustainable Development Goals

CLIMATE ACTION