**University of Zagreb Faculty of Agriculture**
Svetošimunska cesta 25, 10000 Zagreb
Phone: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

# Mineralogy and petrology (146034)

## Course coordinator

**Prof. Nenad Tomašić, PhD**

## Course description

Aquirement of basic knowledges in mineralogy and petrology.
Capability of identification of the most common minerals and rock types.
Understanding of fundamental processes of mineral and rock formation as well as their alteration and weathering processes important for pedogenesis and soil transformation.

ECTS: **3.00**

**Teaching hours: 30**
Lectures: 19
Practicum: 9
Seminar: 2

**Grading**

Sufficient (2): 50%
Good (3): 65%
Very good (4): 80%
Excellent (5): 90%

## Type of course

- Graduate studies / Environment, agriculture and resource management (Compulsory course, 1 semester, 1 year)

## General competencies

Capability of recognition of the most common rocks and minerals.
Understanding of basic processes in the formation of minerals and rocks, and their occurrence in nature.
Comprehension of the role of minerals, rocks, and their alteration / weathering in soil formation and its properties.

## Types of instruction

- Lectures
- Practicum
  observation and discussion of the most distinguishable properties of the most common minerals and rocks
- Seminars
  a panel discussion on the selected rock-soil horizon profiles in respect of weathering processes. The students will be divided into several groups and each group will be provided in advance with written materials on the topics. Each group will be given equal time to present the specific problem assigned, and to discuss it with rest of the students.

## Learning outcomes

Developed by Superfluo d.o.o. • www.superfluo.hr

**University of Zagreb Faculty of Agriculture**
Svetošimunska cesta 25, 10000 Zagreb
Phone: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

| Learning outcome | Evaluation methods |
|---|---|
| Knowledge of the Earth's structure, formation and composition of the Earth's crust, tectonic plates, plate tectonics and the related rocks formation. | Midterm exam |
| Knowledge of basic crystallographic, physical and crystal-chemical properties of minerals. | Midterm exam |
| Knowledge of crystal-chemical classification of minerals and the most common silicate and non-silicate minerals. | Midterm exam |
| Knowledge of the most common types of magmatic, metamorphic and sedimentary rocks. | Midterm exam |
| Capability to identify the most common minerals and rocks. | Oral exam |
| Understanding of fundamental processes in the Earth's crust important in formation of minerals and rocks. | Midterm exam |
| Knowledge and understanding of alteration and weathering processes (mechanical, chemical and biogenic) of minerals and rocks, in respect of pedogenesis and mineral distribution throughout soil profile. | Midterm exam |

# Working methods

## Teachers' obligations

Regular maintenance of all forms of teaching. The time for consultations out of lectures.

## Students' obligations

Regular class attendance and completing of assigned tasks.

# Methods of grading

| Evaluation elements | Maximum points or Share in evaluation | Grade rating scale | Grade | Direct teaching hours | Total number of average student workload | ECTS |
|---|---|---|---|---|---|---|
| 1st midterm exam | 25% | | | | | 0.5 |
| 2nd midterm exam | 25% | | | | | 0.5 |
| Final oral exam | 50% | | | | | 1 |
| Total | 100 % | | | | | 2 |

Developed by Superfluo d.o.o. • www.superfluo.hr

**University of Zagreb Faculty of Agriculture**
Svetošimunska cesta 25, 10000 Zagreb
Phone: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

# Weekly class schedule

1. The Earth's composition, crust, plate tectonics, rock types and their formation L - Composition of the Earth; Formation and composition of the Earth's crust; Lithosphere; Tectonic plates and plate tectonics; Plate margins and related magmatic processes. General classification of rocks after their formation (igneous, metamorphic, sedimentary) with basic sub-division (igneous: intrusive and extrusive; metamorphic (contact and regional); sedimentary (clastic, chemical and biogenic). Rock structure and texture. Typical representatives of each rock type discussed.
2. Minerals: definition and crystallographic properties L - Definition of mineral (after International Mineralogical Association). Crystallographic properties of minerals: definition of crystal, crystal systems, symmetry elements, crystal faces, crystal form, crystal habit.
3. Physical and optical properties of minerals, Physical properties of minerals L+E - Physical properties of minerals: density, hardness, cleavage, parting, colour, lustre. Observation of physical properties by examining the minerals showing specific physical features (Mohs's scale of hardness, different cleavage and lustre types, idiochromatic and alochromatic colours).
4. System of mineralogy: native elements, sulphides L - Crystal-chemical fundamentals in system of mineralogy. Native elements and the most common sulphides and sulphosalts.
5. Oxides, hydroxides, oxisalts; Non-silicate minerals L+E - The most commons oxides, hydroxides and oxisalsts (carbonates, sulphates, phosphates).Observation of the samples of the most common sulphides (pyrite, galena, sphalerite, stibnite, orpiment, realgar, tetrahedrite), oxides (corundum, hematite, cuprite, rutile, cassiterite, pyrolusite, quartz, chromite, magnetite), hydroxides (goethite, limonite) and oxysalts (calcite, dolomite, cerussite, gypsum, malachite, azurite, anglesite, halite*).
6. Non-silicate minerals, Silicates: classification after SiO4 polyhedra polymerisation E+L - Observation of the samples of the most common sulphides (pyrite, galena, sphalerite, stibnite, orpiment, realgar, tetrahedrite), oxides (corundum, hematite, cuprite, rutile, cassiterite, pyrolusite, quartz, chromite, magnetite), hydroxides (goethite, limonite) and oxisalts (calcite, dolomite, cerussite, gypsum, malachite, azurite, anglesite, halite*).Classification of silicate minerals after SiO4 polyhedra polymerisation explained by the structures of the most common silicates: nesosilicates, sorosilicates, cyclosilicates, inosilicates, phyllosilicates ad tectosilicates.
7. Silicates: classification after SiO4 polyhedra polymerisation L - Classification of silicate minerals after SiO4 polyhedra polymerisation explained by the structures of the most common silicates: nesosilicates, sorosilicates, cyclosilicates, inosilicates, phyllosilicates ad tectosilicates.
8. Silicates: classification after SiO4 polyhedra polymerisation, Primary silicate minerals L- Classification of silicate minerals after SiO4 polyhedra polymerisation explained by the structures of the most common silicates: nesosilicates, sorosilicates, cyclosilicates, inosilicates, phyllosilicates ad tectosilicates. Primary silicate minerals: feldspars, pyroxenes, amphiboles, olivines and micas.
9. Secondary silicate minerals L - Secondary silicate minerals: clay minerals (kaolinite, illite, chlorites, smectites) and zeolites.
10. Silicate minerals E - Observation of the samples of the most common silicate minerals: feldspars (potassium feldspars, plagioclase), pyroxenes, amphiboles, olivines, micas, aggregates of clay minerals, zeolites.
11. The most common types of rocks – classification L - Classification of different rocks types: igneous rocks (field classification), metamorphic rocks depending on degree of regional metamophism, classification of clastic sedimentary rocks after granulometric composition, classification of carbonate rocks, marl, loess.
12. The most common types of rocks – classification, Rock types L+E - Classification of different

Developed by Superfluo d.o.o. • www.superfluo.hr

**University of Zagreb Faculty of Agriculture**
Svetošimunska cesta 25, 10000 Zagreb
Phone: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

rocks types: igneous rocks (field classification), metamorphic rocks depending on degree of regional metamorphism, classification of sedimentary rocks after granulometric composition, classification of carbonate rocks, marl, loess. Observation of the most common rock types. Igneous rocks: granite, trahi-andesite, basalt, gabbro, peridotite. Metamophic rocks: marble, slate, phyllite, mica schist, gneiss, eclogite, granulite. Sedimentary rocks: conglomerate, breccia, sandstone, marl, limestone, dolomite.

13. Rock types, Rock weathering: mechanical, chemical and biogenic weathering E+L - Observation of the most common rock types. Magmatic rocks: granite, trahi-andesite, basalt, gabro, peridotite. Metamophic rocks: marble, sleit, phyllite, mica schist, gneiss, eclogite, granulite. Sedimentary rocks: conglomerate, breccia, sandstone, marl, limestone, dolomite. Different mechanisms of rock weathering: Mechanical weathering: fluvial erosion, marine abrasion, aeolian corrasion, glacier erosion. Chemical weathering: dissolution of minerals, dependence of pH and eH; Dissolution of carbonates (karst). Biogenic weathering: organisms as weathering agents, root systems as wathering agents, influence of bio-acids to mineral and rock degradation.
14. Rock weathering: physical, chemical and biogenic weathering, Minerology of soils: minerals through the soil horizons L - Different mechanisms of rock weathering: Physical weathering: fluvial erosion, marine abrasion, aeolian corrasion, glacier erosion. Chemical weathering: dissolution of minerals, dependence of pH and eH; Dissolution of carbonates (karst). Biogenic weathering: organisms as weathering agents, root systems as weathering agents, influence of bio-acids to mineral and rock degradation. Dependence of mineral composition in soil on parent rock. Mineral distribution in soil horizons in different climatic regions: moderate, arid, tropical humid and subpolar regions. Dominant physical and chemical processes important for mineral accumulation in different soil horizons.
15. Exam S

## Obligatory literature

1. Klein, C. & Hurlbut, C. S. (1993): Manual of MIneralogy, Joh Wiley & Sons, p. 681
2. Blatt, H. & Tracy, R.J. (1996): Petrology. Igneous, Sedimentary and Metamorphic.- W.H. Freeman and co., 529 pp
3. Meunier, A. (2005): Clays, Springer-Verlag, p. 472

## Recommended literature

1. Klein, C. & Philpotts, A. R. (2012): Earth Materials: Introduction to Mineralogy and Petrology, Cambridge University Press, p. 533
2. Velde, B. & Meunier, A. (2008):The Origin of Clay Minerals in Soils and Weathered Rocks, Springer, p. 406

## Similar course at related universities

- Introduction to Geology, Petrology Exercises – Bachelor programme Agricultural Sciences – BOKU – Universität für Bodenkultur Wien

Developed by Superfluo d.o.o. • www.superfluo.hr