Czech University of Life Sciences Prague

Faculty of Environmental Sciences

Final State Examinations for Master Programmes – Thematic Areas

2016-2017

Environmental Geosciences

The final state exam consists of 4 exams of different fields. There are three compulsory exams **– Geology, Environmental geology and Earth Science** and **Environmental Geochemistry and Mineralogy**. The other can be chosen from **Environmental Hydrogeology, Paleoecology, Environmental Analytical Chemistry** and **Environmental Soil Chemistry.**

GEOLOGY

1. **Structure of silicates.**

(Tetrahedrons SiO_4, octahedrons AlO_6, clay minerals, micas, feldspars. classification of silicates.)

2. **Magmatic (igneous) rocks.**

(Classification of igneous rocks, main types, genesis, structures, important minerals of igneous rocks, pyroclastic rocks.)

3. **Sedimentary rocks**

(Classification of sedimentary rocks, main types, genesis, structures, important minerals of sedimentary rocks, karsts, elluvial rocks.)

4. **Metamorphic rocks.**

(Classification of metamorphic rocks, main types, genesis, structures, important minerals of metamorphic rocks.)

5. **Endogenous dynamics.**

(Creative and disturbing endogenous activity, earthquakes, volcanism, tectonics, lithosphere plates.)

6. **Exogenous dynamics.**

(Creative and disturbing exogenous activity, activity of wind, gravity, sea water, fresh water, organisms, glaciers.)

7. **Lithosphere plate tectonics and Wilson cycle.**

(Rift valleys, oceans, subduction, island arcs, sea floor spreading,hot spots, middle oceanic mountain ridges, continental and oceanic lithosphere, orogenetic belts, deep sea trench.)

8. **Historical geology.**

(Eras and periods, fossils and evolution, settlement of continents, extinctions, ice ages, evolution of man and quarternary.)

ENVIRONMENTAL HYDROGEOLOGY

1. Water in the porous media (Aquifer and Aquitard); principles of GW flow, Darcy‘s law; Transmissivity and Storativity (storage coefficient)
2. Groundwater movement thought the different porous media; hydrogeological structures (seepages and springs)
3. Physicochemical and chemical properties of the groundwater
4. Processes affecting the chemical composition of the groundwater
5. Transport processes of Groundwater
6. Modelling in HG (water flow and solute transport in saturated and unsaturated zone)
7. Overview of the main contaminants of groundwater; main types of groundwater contamination
8. General principles and methods of a pollution survey; remediation of groundwater
9. Drilling mode and techniques; construction of hydrogeological boreholes
10. Collection of groundwater and technical measuring/sampling; pumping technologies
11. Hydrogeological aquifer tests; tracer tests

PALEOECOLOGY

Environmental controls on biotic distribution

1. The structure of the biosphere
2. Divisions of the marine environment
3. Limiting factors of the distribution of organisms (light, nutrients, oxygen, temperature and salinity)

Taphonomy

1. Preservation potential amongst biological communities

2. Destruction by physical, biological and chemical processes on the sediment surface
3. Preservation and destruction of shells below the sediment surface
4. Fossil Lagerstätten - the exceptional preservation of fossils

Trace fossils

1. Preservation and taxonomy of trace fossils
2. Trace fossils and paleoenvironments
3. Marine and marginal marine ichnofacies

Fossils as environmental indicators

1. Biofacies distribution
2. Fossils as bathymetric indicators for marine shelf sediments
3. Environmental indicators in deep marine sediments
4. Carbonate environments (carbonate ramps, rimmed shelves and epeiric basins)
5. Oxygen deficient environments
6. Environments with high and low salinity
7. Shell concentrations, sedimentation rate and sequence stratigraphy

Populations and communities

1. Population structure and dynamics (types of populations, size-frequency analyses)
2. Community structure (paleocommunities, numerical analysis of community data)
3. Community organization (trophic structure, tiering, coevolution and community succession)
4. Species diversity (diversity patterns on different scales, diversity trend in marine habitats, and measuring diversity in palaeontological samples)
5. Environmental distribution of Phanerozoic communities

Paleobiogeography

1. Concepts and definitions
2. Controls on biogeography (dispersal and vicariance biogeography)
3. Recognition of past biogeographic provinces
4. Paleoclimatology
5. Plate movements

Evolutionary paleoecology of the marine biosphere

1. The early history of life
2. Diversification events in Earth history (the origin of life and the earliest Procaryota, appearance of the Eucaryota, appearance of the Metazoa)
3. The early Cambrian evolutionary explosion
4. Diversification of the three great evolutionary faunas
5. Patterns of extinction (analysing patterns of extinction, causes of extinction, recovery from mass extinctions)
6. The effect of major extinctions on evolution (radiation, stasis and extinction)

Fossil terrestrial ecosystems

1. Initial adaptations and the early terrestrial record (plants and animals)
2. Terrestrial ecosystems through time (Palaeozoic and Mesozoic ecosystems)
3. Mass extinctions

ENVIRONMENTAL GEOCHEMISTRY AND MINERALOGY

1. Global biogeochemical cycle of carbon
2. Global biogeochemical cycle of sulfur
3. Biogeochemical cycle of nitrogen
4. Geochemistry of the lithosphere
5. Geochemistry of the hydrosphere
6. Analytical methods in environmental geochemistry and mineralogy
7. Principles of isotope geochemistry
8. Basics of soil geochemistry

ENVIRONMENTAL GEOLOGY AND EARTH SYSTEM SCIENCE

1. Geochemistry and composition of Earth
2. Mineralogy and petrology in environmental sciences
3. Basics and principles in isotope geochemistry
4. Basics and principles in paleoecology
5. Basics and principles in environmental geochemistry, including biogeochemical cycles
6. Basics and principles in environmental analytical chemistry
7. Basics and principles in regional geology
8. Basics and principles in environmental hydrogeology

ENVIRONMENTAL SOIL CHEMISTRY

1. Geochemical and mineralogical composition of soils
2. Adsorption processes in soils
3. Soil contamination; behavior of inorganic and organic contaminants in soils
4. Soil acidification
5. Analytical methods in soil sciences
6. Soil erosion

7. Soil characterization and soil types
8. Transport processes in soils

ENVIRONMENTAL ANALYTICAL CHEMISTRY

1. Introduction to Environmental Analytical Chemistry; general principles and techniques
2. Analytical data, their assessment and interpretation
3. Basic chemical principles
4. Sampling, sample preparation and sample treatment
5. Titrimetry and gravimetry
6. Separation techniques
7. Atomic spectrometry
8. Mass spectrometry
9. Molecular spectrometry
10. Isotope analyses
11. Elemental analyses

Suggested Literature:

BRENCHLEY P. J., HARPER D. A. T.; 1998: Palaeoecology :ecosystems, environments and evolution. 1st ed. London: Chapman & Hall, xxv, 402 s. ISBN 0-412-43450-4.

BRIGGS D. E. G., CROWTHER P. R., eds; 2003: Paleobiology II. Malden, Massachusetts: Blackwell Publishing. ISBN 0-632-05147-7 and ISBN 0-632-05149-3.

SELDEN P., NUDDS J.; 2005: Evolution of Fossil Ecosystems. Chicago: University of Chicago Press. ISBN 978-0-226-74641-8 and ISBN 0-226-74641-0. A recent analysis and discussion of paleoecology.

TUCKER M. E.; 1999: Sedimentary Petrology. An Introduction to the Origin of Sedimentary Rocks. Blackwell Scientific Publications, 324 s.

WHITTEN, D.G.A., BROOKS, J.R.V.; 1979: The Penguin Dictionary of Geology. Penguin Books, 520 s.

BAUER, J., TVRZ, F.; 1979: A Field Guide in Color to Minerals, Rocks and Precious Stones. Praha: Artia, 208 s.

PLUMMER, C. C., McGEARY, D.; 1993: Physical Geology. Wm. C. Brown Publishers, 366 s.