

Final State Examinations for Master Programmes – Thematic Areas

2019

**Environmental Geosciences**

The final state exam consists of 4 exams of different fields. There are three compulsory exams

Geology, Environmental Soil Chemistry and Environmental Geochemistry

and Mineralogy. The other can be chosen from Environmental Hydrogeology, Paleoecology,Environmental Analytical Chemistry and Waste Geochemistry and Management

1. **GEOLOGY**

1. Structure of silicates.

(Tetrahedrons SiO4, octahedrons AlO6, 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 quartemary.)

1. **ENVIRONMENTAL GEOCHEMISTRY AND MINERALOGY**
2. Global biogeochemical cycle of carbon
3. Global biogeochemical cycle of sulfur
4. Biogeochemical cycle of nitrogen
5. Geochemistry of the lithosphere
6. Geochemistry of the hydrosphere
7. Analytical methods in environmental geochemistry and mineralogy
8. Principles of isotope geochemistry
9. Basics of soil geochemistry
10. **ENVIRONMENTAL SOIL CHEMISTRY**
11. Geochemical and mineralogical composition of soils
12. Adsorption processes in soils
13. Soil contamination; behavior of inorganic and organic contaminants in soils
14. Soil acidification
15. Analytical methods in soil sciences
16. Soil erosion
17. Soil characterization and soil types
18. Transport processes in soils
19. **ENVIRONMENTAL HYDROGEOLOGY**
20. Water in the porous media (Aquifer and guitard), principles of GW flow, Darcy´s law; Transmissivity and Storativity (storage coefficient)
21. Groundwater movement thought the different porous media; hydrogeological structures (seepages and springs)
22. Physicochemical and chemical properties of the groundwater
23. Processes affecting the chemical composition of the groundwater
24. Transport processes of Groundwater
25. Modelling in HG (water flow and solute transport in saturated and unsaturated zone)
26. Overview of the main contaminants of groundwater; main types of groundwater contamination
27. General principles and methods of a pollution survey; remediation of groundwater
28. Drilling mode and techniques; construction of hydrogeological boreholes
29. Collection of groundwater and technical measuring/sampling; pumping technologies
30. Hydrogeological aquifer tests; tracer tests
31. **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- 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

1. **Waste Geochemistry and Management**
2. Characterization of waste types and principles of waste treatment
3. Municipal solid waste – definition, characterization, treatment
4. Mining waste – definition, generation, characterization
5. Metallurgical waste – definition, generation, characterization
6. Chemical and radioactive waste – definition, characterization, treatment
7. Leaching tests for waste assessment
8. Landfilling
9. Waste management – principles and legislation
10. **ENVIRONMENTAL ANALYTICAL CHEMISTRY**
11. Introduction to Environmental Analytical Chemistry; general principles and techniques
12. Analytical data, their assessment and interpretation
13. Basic chemical principles
14. Sampling, sample preparation and sample treatment
15. Titrimetry and gravimetry
16. Separation techniques
17. Atomic spectrometry
18. Mass spectrometry
19. Molecular spectrometry
20. Isotope analyses
21. Elemental analyses

**Suggested Literature:**

Brenchley P.J., Harper D.A.T.;1998: Palaeocology: ecosystems, environments and evolution. 1.st ed London: Chapmanand 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 discusssion of paleoecology.

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

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

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

Plummer, C. C., McGeary, D.; 1993: Physical Geology. Wm. C. Brown Publishers, 366 s.