Programme-specific Section of the Curriculum for the MSc Programme in Geology-Geoscience at the Faculty of Science, University of Copenhagen 2021

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1 Title, affiliation and language
A shared section that applies to all BSc and MSc Programmes at the Faculty of Science is linked to this programme-specific curriculum.

1.1 Title
The MSc Programme in Geology-Geoscience with the Danish title: Cand.scient. (candidatus/candidata scientiarum) i geologi-geoscience.

1.2 Affiliation
The programme is affiliated with the Study Board of Geosciences and Management, and the students can both elect, and be elected, to this study board.

1.3 Corps of external examiners
The following corps of external examiners is used for the central parts of the MSc Programme:
- Corps of External Examiners for Geology (geologi).

1.4 Language
The language of this MSc Programme is English.

2 Academic profile
2.1 Purpose
Geology-Geoscience is a term for the sciences concerned with the Earth, geological materials, processes and structures, as well as the study of the history of the Earth and of life on Earth within a temporal framework. The MSc Programme in Geology-Geoscience programme is a research-based study programme, the objective of which is to provide students with knowledge, skills and competences within the central subjects of the programme.

2.2 General programme profile
The study programme is initiated by a common compulsory course structured around the 3 research groups. The elective subjects include a number of specialist courses, a project course, a practical course and a field and method course. The thesis, which concludes the MSc programme, is an independent experimental, field-based or theoretical study within a clearly defined area of the geological fields of study.

The key subject areas of the programme are: Formation and evolution of the Earth, geological materials, processes and structures, and the study of the history of the Earth, of the climate of the Earth and of life on Earth within a temporal framework.

2.3 General structure of the programme
The MSc Programme is set at 120 ECTS.

There are no defined specialisations in this programme.

2.4 Career opportunities
The MSc Programme in Geology-Geosciences qualifies students to become professionals within business functions and/or areas such as:
- Provide the student with the qualifications required to independently take on job functions based on the methods and scientific foundation of the geological subjects covered.
- Provide the student with the qualifications required to take part in scientific work within the areas of the chosen specialisation.
- A PhD programme.
3 Description of competence profile

Students following the MSc Programme acquire the knowledge, skills and competences listed below depending on the courses taken. Students will also acquire other qualifications through elective subject elements and other study activities.

Knowledge about:

- The principles for formulating geoscientific questions, planning and managing geoscience studies and reporting on findings at an academically appropriate level.
- The integration of field-based data with relevant analysis methods to solve complex geoscientific problems at a high academic level.
- The geochemical composition, evolution and differentiation of the core-mantle-crust system.
- Geochemical tracers and their applicability to characterizing Earth’s geochemical components and our understanding of high-temperature petrological processes and past environmental conditions.
- Geological and geochemical processes leading to ore deposit formation.
- The essential elements in the analyses of sedimentary systems, incl. types of sedimentary basins within a plate-tectonic framework, (bio-)geochemical cycles, sedimentology, reflection seismic interpretation, and the nature and significance of flora and fauna in various sediments.
- Geological resources associated with sedimentary systems, incl. geothermal energy and CO2 storage.
- Climate archives, incl. geochemical, sedimentary and palaeobiological proxies.
- Theoretical background, development and application of geophysical methods, such as seismology, magnetics, gravity, electrical, electromagnetic, GPR.
- Imaging of Earth structure from the near-surface to the deep interior with geophysical methods.
- Interpretation of geological and geodynamic processes and understanding of the state of the Earth based on geophysical methods/data.
- Groundwater resources, aqueous geochemistry and contaminant hydrogeology.
- Advanced hydrological modelling and water resources management.
- Climate change and water resources.

Skills in/to:

- Participate in and undertake the planning of a geoscience study.
- Analyse a geoscience problem, devise a working model, collect and analyse geoscience data and prepare an academically sound and detailed scientific report.
- Combine geoscience field and laboratory-based experience within the specified area of geology-geoscience.
- Describe the general characteristics of, differences between, and origin of Earth’s various geochemical reservoirs.
- Apply geochemical tracers to identify, characterize, and quantify high-temperature petrological processes.
- Demonstrate an understanding of the formation of economic mineral deposits.
- Analyse a sedimentary system on a broad range of scales in both time and space using a wide range of data, incl. sedimentological observations, seismic profiles, well logs, geochemistry, biogeochemistry and palaeobiology.
- Investigate the occurrence of resources, incl. geothermal energy and CO2 storage, associated with sedimentary systems.
- Analyse Earth’s climate history using geochemical, sedimentological and palaeobiological proxies.
- Interpretation of rock physical properties and geological structure based on geophysical methods.
Proper treatment of geophysical data for optimized data quality.
Linking rock physical parameter properties and geological structure for understanding dynamic Earth processes.
Perform hydrological modelling and water resources management under current and future climate conditions.
Carry out field measurements of hydraulic parameters and apply models for groundwater flow and transport for heterogeneous aquifer systems.
Interpret and carry out quantitative modelling of geochemical reactions in porous media and coupling to groundwater flow.

Competences in/to:
- Explaining core academic areas, disciplines, theories and working methods within the field of geology-geoscience.
- Understanding geological work functions and development tasks requiring new solution models.
- Independently implementing and carrying out monodisciplinary and interdisciplinary collaboration and assume professional responsibility.
- Independently assuming responsibility for their own professional development and specialisation and critically seek, read and assess specialist literature.
- Demonstrating familiarity with the geological processes that produce geochemical diversity on scales varying from single eruptions to the entire core-mantle-crust-hydrosphere-atmosphere system in the past and present.
- Explaining chemical and mineralogical variations within Earth’s different geochemical reservoirs in terms of geochemical processes linked to modern plate tectonic theory and geodynamics.
- Describing geochemical and thermodynamic processes that result in the formation of economically important concentrations of minerals and materials needed in modern society.
- Explain the fundamental concepts and processes of the essential elements of sedimentary systems analysis.
- Provide an integrated synthesis of the formation, stratigraphic evolution and occurrence of resources in a sedimentary system based on a wide range of data.
- Provide an integrated interpretation of Earth’s climate record based on a wide range of data.
- Application of quantitative and theoretical methods for solving linked geophysical-geological problems.
- Choosing and application of suitable geophysical methods for solving geoscientific problems.
- Description and characterization of Earth structure, dynamics, physical properties and evolution.
- Collecting and critically evaluating existing and new interdisciplinary data on hydrology, geology, geophysics, hydrogeology and geochemistry.
- Calibrating and applying hydrological models to assess water resources, to support water resources management, to assess impact of climate change, to solve flow and transport problems in the unsaturated zone and groundwater.
- Analysing the impact of the geological settings on subsurface flow and transport.

4 Admission requirements
With a Bachelor’s degree in Geology-Geoscience from the University of Copenhagen the student is granted reserved access and guaranteed a place at the MSc Programme in Geology-Geoscience if the student applies in time to begin the MSc Programme within three years of the completion of the Bachelor's degree.
4.1 Applicants with a Bachelor’s degree in Geology-Geoscience
Applicants with a Bachelor’s degree in Geology-Geoscience from the University of Copenhagen are directly academically qualified for admission to the MSc Programme.

4.2 Applicants with a related Bachelor’s degree
Applicants with a Bachelor’s degree in the following:
- Geography and Geoinformatics from the University of Copenhagen.
- Geoscience from Aarhus University.
- Geology from international universities.
- Within related areas from the University of Copenhagen, other Danish, Nordic or international universities.

may also be admitted if their programme includes the following:
- Subject elements on bachelor’s level within the academic field of geology-geoscience, 60 ECTS.

4.3 Other applicants
The Faculty may also admit applicants who, after an individual academic assessment, are deemed to possess educational qualifications equivalent to those required in Subclauses 4.1-2.

4.4 Language requirements
Applicants must as a minimum document English language qualifications comparable to a Danish upper secondary school English B level or English proficiency corresponding to the tests and scores required. Accepted tests and required minimum scores are published online at www.science.ku.dk.

4.5 Supplementary subject elements
The qualifications of an applicant to the MSc program are assessed exclusively on the basis of the qualifying bachelor’s degree. Supplementary subject elements passed between the completion of the bachelor’s program and the admission to the MSc program cannot be included in the overall assessment.

However, subject elements passed before the completion of the bachelor’s programme may be included in the overall assessment. This includes subject elements completed as continuing education as well as subject elements completed as part of a former higher education programme. A maximum of 30 ECTS supplementary subject elements can be included in the overall assessment.

Subject elements passed before completing the BSc programme which are to form part of the MSc programme to which the student has a legal right of admission (§12-courses) cannot be included in the overall assessment.

5 Prioritisation of applicants
If the number of qualified applicants to the programme exceeds the number of places available, applicants will be prioritised as follows:

1) Applicants with a Bachelor’s degree in Geology-Geoscience from the University of Copenhagen with reserved access to the programme.
2) Applicants with a Bachelor’s degree in Geology-Geoscience from the University of Copenhagen.
3) Other applicants.
If the number of qualified applicants within a category exceeds the number of places available, applicants will be prioritised according to the following criteria (listed below in prioritised order):

- On the basis of ECTS obtained in study elements within geology-geoscience.

### 6 Structure of the programme

The compulsory subject elements, restricted elective subject elements and the thesis constitute the central parts of the programme (Section 21 of the Ministerial Order on Bachelor and Master’s Programmes (Candidatus) at Universities).

### 6.1 Programme components

The programme is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 15 ECTS.
- Restricted elective subject elements, 30 ECTS.
- Elective subject elements, 15 ECTS.
- Thesis, 60 ECTS.

#### 6.1.1 Compulsory subject elements

All of the following subject elements are to be covered (15 ECTS):

- NIGK21001U Integrating Fundamental Concepts in Geosciences

#### 6.1.2 Restricted elective subject elements

30 ECTS are to be covered by subject elements from the following list:

<table>
<thead>
<tr>
<th>Subject Element</th>
<th>Title</th>
<th>Block</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIGK21003U</td>
<td>Early Earth - Formation and History</td>
<td>2</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21004U</td>
<td>Palaeontology and History of Life</td>
<td>2</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK14056U</td>
<td>Climate change and water resources</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>NIGK21002U</td>
<td>Processing of Seismic and Georadar Data</td>
<td>2</td>
<td>7.5</td>
</tr>
<tr>
<td>SGBK20009U</td>
<td>Stardust to Planets: Building a Habitable Solar System</td>
<td>2</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21005U</td>
<td>Geological Evolution Based on Interpretation and Integration of Reflection Seismic and Wireline Log Data</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21006U</td>
<td>Aqueous Geochemistry</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21007U</td>
<td>Integrated Water Resources</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21008U</td>
<td>Geodynamics - Shaping Earth's Surface</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21009U</td>
<td>Melting in the Earth's Mantle - Tracing Sources and Processes</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21010U</td>
<td>Integrated Sedimentary Systems Analysis</td>
<td>4</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21011U</td>
<td>Mineral Resources</td>
<td>4</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21035U</td>
<td>Past Climate</td>
<td>4</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK19001U</td>
<td>Introduction to geomicrobiology</td>
<td>4</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK21012U</td>
<td>Contaminant Hydrogeology</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>NIGK19004U</td>
<td>Marine Geoscience</td>
<td>5</td>
<td>7.5</td>
</tr>
<tr>
<td>NIGK15007U</td>
<td>Field and methods course in Geology-Geoscience</td>
<td>1+2 / 3+4</td>
<td>15</td>
</tr>
</tbody>
</table>

#### 6.1.3 Elective subject elements

15 ECTS are to be covered as elective subject elements.

All subject elements at MSc level may be included as elective subject elements in the MSc Programme.

BSc subject elements corresponding to 7.5 ECTS may be included in the MSc Programme.
Projects outside the course scope may be included in the elective section of the programme with up to 7.5 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may not exceed 15 ECTS in total of the restricted elective and elective section of the programme. Project in practice may be written as a combination of the restricted elective and elective section of the programme. The regulations are described in Appendix 4 to the shared section of the curriculum.

Thesis preparation projects may not be included in the elective section of the programme. The regulations are described in Appendix 6 to the shared section of the curriculum.

6.1.4 Thesis
The MSc Programme in Geology-Geoscience includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.1.5 Academic mobility
The curriculum makes it possible to follow subject elements outside the Faculty of Science.

The academic mobility for the MSc Programme in Geology-geoscience is placed in block 3+4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition the student has the possibility to arrange similar academic mobility in other parts of the programme.

7 Exemptions
In exceptional circumstances, the study board may grant exemptions from the rules in the curriculum specified solely by the Faculty of Science.

8 Commencement etc.
8.1 Validity
This subject specific section of the curriculum applies to all students enrolled in the programme – see however Appendix 2.

8.2 Transfer
Students enrolled on previous curricula may be transferred to the new one as per the applicable transfer regulations or according to an individual credit transfer by the study board.

8.3 Amendments
The curriculum may be amended once a year so that any changes come into effect at the start of the academic year. Amendments must be proposed by the study board and approved by the Dean.

Notification about amendments that tighten the admission requirements for the programme will be published online at www.science.ku.dk one year before they come into effect.

If amendments are made to this curriculum, an interim arrangement may be added if necessary to allow students to complete their MSc Programme according to the amended curriculum.
Appendix 1 Tables

Table – MSc Programme in Geology-Geoscience

<table>
<thead>
<tr>
<th></th>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>Integrating Fundamental Concepts in Geosciences</td>
<td>Restricted elective</td>
<td>Restricted elective</td>
<td>Restricted elective</td>
</tr>
<tr>
<td></td>
<td>Restricted elective</td>
<td>Elective</td>
<td>Elective</td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td>Compulsory</td>
<td>Thesis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Appendix 2 Interim arrangements

The Shared Section of the BSc and MSc Curricula for Study Programmes applies to all students.

There are currently no interim arrangements to this curriculum.

Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:
- Identifying scientific problems within the subject areas for the chosen geological specialisation.
- Summarising a combination of methodologies/theories based on international research for use in the work with problem formulation.
- Discussion of theories/models on the basis of and with a high degree of independence.

Skills to:
- Apply and critically evaluate theories/methodologies in the field of geoscience, including their applicability and limitations.
- Assess the extent to which the production and interpretation of findings/material obtained in the study depend on the theory/methodology and the constraints chosen.
- Draw conclusions in a clear and academic manner in relation to the problem formulation and considering the topic and the subject area of the thesis.
- Discuss and communicate the significance of the thesis on the basis of previous data, earlier research and geological theory.
- Conduct experimental work/producing own geological data relevant to the topic as formulated in the problem formulation.
- Process geological data through a choice of academic analysis methods and present findings objectively and in a concise manner.
- Assess the credibility of own findings based on relevant data processing.

Competences in:
- Initiating and performing academic work within the research context of the chosen study programme and geological specialisation.
- Solving complex problems and carrying out development assignments in a general geological context.