EARTH SCIENCE FOR FOREIGN STUDENTS

A one-year course of study is offered for science students in the Faculty of Earth Sciences. It covers topics in geology, oceanography, and geophysics. Emphasis will be put on aspects of Icelandic geology like volcanic and geothermal activity, glaciers and plate tectonics, as well as the North Atlantic Ocean. The course should be suitable for Erasmus exchange students from the EU and others who want to spend one or two semesters in Iceland as a part of their university education. We recommend a minimum background of one year of undergraduate study in earth science. All teaching is in English. Course descriptions are given below.

WHY STUDY EARTH SCIENCE IN ICELAND?

Owing to Iceland’s geographical position in the North Atlantic, and its geotectonic position over a mantle plume and astride the Mid-Atlantic Ridge, geological and tectonic processes are extraordinarily rapid and easily observed in Iceland. On the constructive side, some 20 to 30 volcanic eruptions occur every century on average, producing lava in the order of 45 km³/1000 years. This production is counterbalanced by equally rapid destructive processes: thermal contraction, erosion by the North Atlantic waves, and by glaciers, wind and rain. Chemical erosion, too, is surprisingly rapid owing to the highly reactive nature of the volcanic glass created in the Pleistocene sub-glacial eruptions.

In Iceland, some 400 km are exposed of the Mid-Atlantic ridge, allowing the student to observe and investigate the tectonic processes of crustal accretion, the central rift, fracture zones, submarine/subglacial volcanism and associated features and processes. The volcanics, too, are surprisingly varied both compositionally and in terms of appearance – from picrite to rhyolite, from glass to plutonic rock. Associated with the volcanoes are numerous geothermal systems, ranging from fresh-water to saline, and from warm to super-critical temperatures. Over 40% of Iceland’s total energy consumption is geothermal, being an example of environment-friendly exploitation of nature.

Glaciers, large and small, cover about 10% of the country. This permits the hands-on study of periglacial environments similar to those that existed in Europe and N-America 10,000 years ago. The glaciers feed large glacial rivers in which subglacial volcanic eruptions and geothermal areas occasionally cause large floods (jökulhlaup). Nowhere on Earth are glaciers and large ice caps more easily accessible for study than in Iceland.

SO, WHY STUDY EARTH SCIENCE IN ICELAND - UNDER THE GUIDANCE OF UNIVERSITY PROFESSORS HAVING LONG RESEARCH EXPERIENCE AND WHO ARE ACTIVE IN THE INTERNATIONAL ARENA IN THEIR RESPECTIVE FIELDS OF STUDY?

Modern geology is process-oriented, and Iceland is exceptionally well suited for the study of various geological processes. Here the raw elements that have shaped the Earth throughout most of its 4.5 billion years’ history are creating and molding the surface and lithosphere faster than in most other places. Therefore, geophysicists and physical geographers alike, geochemists, petrologists, will all benefit a great deal from studying in Iceland – learn how the forces of nature created the Earth we know, and how they shape the living conditions in Iceland.

Please keep in mind that not all of the courses might be available for each school year.

Further information can be found in the course catalogue for the University of Iceland: https://ugla.hi.is/kennsluskra/index.php?tab=skoli&chapter=content&id=-2014&kennsluar=2014&lang=en
FALL SEMESTER

JAR106G Introduction to the Geology and Geography of Iceland - 10 ECTS - Module: H

1-week excursion (end of August) followed by 12 lectures per week in September.

Supervision: Ármann Höskuldsson, Research professor

A maximum of 45 students can be registered for the excursion. The excursion is not available without being registered into the course. Minimum background of one year of undergraduate study in earth science is required for this course.

a) 1 week excursion at the end of August

A one-week study tour in South Iceland, with focus on both constructive and destructive geological processes, as well as human activities in the region. The tour is integrated with the course “Introduction to the Geology and Geography of Iceland”. Students will observe active volcanoes (albeit probably not erupting), geothermal activity, glaciers and glacial rivers, weathering and erosional processes and flora and fauna.

The settlement and economy of the region are studied, including visits to a geothermal greenhouse, industrial plant, and fish factory. The students will keep a field diary as well as working on specified themes, according to their interests and the courses they plan to take later in the programme. Lodgings will be at Youth Hostels or farms, and food will be provided. The last week of September will be devoted to writing a report and preparing for a quiz on the entire course. Students pay a participation fee: 35,000.ISK. for this part of the course.

b) 12 lectures/week through September

The course, which is coupled with the S-Iceland Study Tour at the end of August, aims to provide an overview of Icelandic geology and geography, with emphasis on themes that are of special interest to Iceland, so as to provide a common foundation for the courses that follow from October onwards. Lectures cover the tectonic setting and tectonics of Iceland, general geology, geomorphology and weathering, climate and climatic history, petrology, volcanology, glaciology and glacial geology, cold and hot water geochemistry, hydraulics and N-Atlantic descriptive oceanography.

Text: Einarsson, Geology of Iceland.

JED104G Introduction to Geophysics - 6 ECTS - Module: H

Supervision: Magnús Tumi Guðmundsson, Professor

An introduction to the physics of the Earth. The course should be suitable as a first course for those majoring in geophysics and for geology students wanting to become familiar with the subject. Gravity, shape and rotation of the Earth, gravity anomalies. The geomagnetic field, magnetic anomalies, palaeomagnetism. Earthquakes and seismic waves. Layered structure of the Earth, heat transport and the internal heat of the Earth. Origin and age of the Earth. Dating with radioactive elements. Geophysics of Iceland, introduction to geophysical research in Iceland.

Text: Fowler, The Solid Earth; journal articles.

JED505G Current Crustal Movements - 6 ECTS - Module: H

Supervision: Páll Einarsson, Professor

The subject of the course is active tectonic movements with emphasis on processes currently active in Iceland. Elastic and ductile behaviour of rocks in the crust and mantle. Brittle fracturing. Isostasy, vertical crustal movements and sea level. Plate velocity models, both relative and absolute. Plate boundary deformation. Riffs and rifting structures. Transcurrent faulting and associated structures. Post-rifting and post-seismic movements. Volcano inflation and deflation, dyking and intrusions. Measuring crustal movements, GPS-geodesy, levelling, SAR-interferometry, sea-level measurements, tilt- and strainmeters. A field project will be carried out.

Texts: Journal articles and chapters from various textbooks.
**JAR108G Igneous Petrology** - 6 ECTS - Module: H

Supervision: Þorvaldur Pórdarson, Professor

Classification of igneous rocks and their relationship to tectonic environment. Evolution of igneous rocks in the light of phase diagrams, trace elements, and isotopes. Petrological lessons from intrusions, the oceanic rifts, oceanic islands, and continental regions.

Petrology of Iceland: volcanic systems, magma series and their relationship to volcano-tectonics; palagonite and palagonitisation. Laboratory exercises with the petrological microscope, interpretation of chemical data, and one-day petrological excursions.

Text: Wilson, Igneous Petrogenesis; journal articles.

---

**JAR503M Chemical Oceanography** - 8 ECTS - Module: H

Supervision: NN

The aim of this course is to introduce interested students with sufficient background in chemistry to chemical oceanography, even though they have no previous oceanography background. The focus is on chemical processes associated with the sea floor and sediments, currents and mixing, biological production and respiration and in particular the role of the ocean in the global carbon cycle. Emphasis is placed on processes in the N-Atlantic Ocean.

Text: Steven Emerson and John Hedges: Chemical Oceanography and the Marine Carbon Cycle

---

**LAN516G Soil Science** - 8 ECTS - Module: H

Supervision: Guðrún Gísladóttir, Associate Professor

**SPRING SEMESTER**

**JAR609G Glaciology** - 8 ECTS - Module: V  
Supervision: Guðfinna Th Aðalgeirsdóttir


**JAR617G Glacial Geology** - 8 ECTS - Module: V  
Supervision: Ólafur Ingólfsson, Professor

This course deals with processes of glacial erosion, glacial sedimentation and glacial morphology. It is aimed at undergraduate students interested in physical geography, glacial geology and glaciology. Lectures will concern glacial systems, glacier movements and glacier hydrology, erosion, sediment transport and deposition, glaciotectonic deformations, erosional and depositional landforms, as well as processes operating in the proglacial environment.

The course ends with a 5-day field course to a southern Iceland outlet glacier, where students will be trained in glacial geological research methods. Students will do individual research projects and write up a report on their results.

**JAR614G Quaternary Environments** - 8 ECTS - Module: V  
Supervision: Áslaug Geirsdóttir, Professor

The aim of the course is to give a comprehensive summary of the environmental change that occurred during the Quaternary period with special reference to Iceland. Contents: The characteristics of the Quaternary and geological evidence for global climatic change.

The history of ice on Earth. How do glaciers work? Glacial debris transport and glacial sedimentation on land and in water. Climate records from polar ice sheets. The glacial and deglacial history of Iceland and the North Atlantic Ocean.

Text: Lowe & Walker, Reconstructing Quaternary Environments; journal articles.
JAR611G Environmental Geochemistry - 8 ECTS - Module: V

Supervision: NN


Text: W. van Loon and Duffy: Environmental Chemistry.

JAR610G Volcanology - 8 ECTS - Module: V

Supervision: Páll Einarsson, Professor


Two field excursions are conducted to a volcanic area.

Text: Francis, Volcanoes; journal articles.

JAR601M Geothermal Energy – 7,5 ECTS - Module: V

Supervision: Andri Stefánsson, Professor

A 7-week intensive course (first 7 weeks of spring term). Heat budget of the Earth, heat transport to the Earth’s surface. Geothermal systems and their structure, renewability of hydrothermal systems, methodology in geothermal development, estimation of resource size, fluid origin and chemistry, water-rock interaction, environmental impact of utilization, well testing and well data integration.
APPLICATIONS

Those who want to apply for the programme should contact the International Office:
University of Iceland
International Office
Haskolatorg, 3rd floor
101 Reykjavik
Iceland
Tel: +354 525 4311
E-mail: incoming@hi.is

Website: http://english.hi.is/university/international_office
Website for international exchange students: http://english.hi.is/university/international_exchange_students
The International Office provides various information of specific and general nature.

PREREQUISITES

The School of Engineering and Earth Sciences, University of Iceland, reserves the right to restrict admission to the Earth Science programme to students having an adequate background of at least one-year study in geology, geophysics, or physical geography. Some courses have required or recommended preparation. A basic knowledge of mathematics and physics is assumed in Introduction to Geophysics, Current Crustal Movements, Volcanology and Glaciology, while some chemical background is required for Environmental Geochemistry and Chemical Oceanography.

Projects beyond the course programme are not offered.
<table>
<thead>
<tr>
<th>FALL SEMESTER, 15 WEEKS AUGUST – DECEMBER</th>
<th>SPRING SEMESTER, 15 WEEKS JANUARY – MAY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction to the Geology and Geography of Iceland</strong> 10 ECTS JAR106G</td>
<td><strong>Glaciology</strong> 8 ECTS JAR609G</td>
</tr>
</tbody>
</table>
| a) 1 week study tour  
b) 3 weeks 12 lectures/week  
c) 1 week report and quiz | **Quaternary Environments** 8 ECTS JAR614G |
| **Introduction to Geophysics** 6 ECTS, 10 weeks JED104G | **Volcanology** 8 ECTS JAR610G |
| **Current Crustal Movements** 6 ECTS, 10 weeks JED505G | **Environmental Geochemistry** 8 ECTS JAR611G |
| **Igneous Petrology** 6 ECTS, 10 weeks JAR108G | **Glacial Geology** 8 ECTS JAR617G |
| **Soil Science** 6 ECTS, 10 weeks LAN516G | **Geothermal Energy** 6 ECTS, 7 weeks JAR601M |
| **Chemical Oceanography** 8 ECTS JAR503M | |

**EARTH SCIENCE IN ICELAND - USEFUL WEBSITES**

Useful information on the University of Iceland and Earth science research in Iceland can be obtained from the following websites:

**University of Iceland websites**

- University of Iceland [http://www.hi.is](http://www.hi.is)
- Institute of Earth Sciences, University of Iceland [http://www.earthice.hi.is](http://www.earthice.hi.is)
- Nordic Volcanological Centre - Volcanoes [http://www.norvol.hi.is](http://www.norvol.hi.is)

**Other useful websites:**

- Icelandic Meteorological Office - Earthquakes [http://www.vedur.is](http://www.vedur.is)
- Icelandic Geosurvey - Various applied research [http://isor.is/](http://isor.is/)
- Geoscience Society of Iceland [http://www.jfi.is](http://www.jfi.is)
- Icelandic Institute of Natural History [http://www.ni.is](http://www.ni.is)
- Marine Research Institute [http://www.hafro.is](http://www.hafro.is)