



Field trip to Etna (southern Italian Volcanism)



Field trip to Sikkim (Northwestern India)



GMG Institute building



RUHR-UNIVERSITÄT Bochum

Further Information:



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**HOW TO APPLY:**

- Prospective students are required to submit their application, along with a copy of their BSc. degree, transcript of records, and an one page statement of purpose.
- Applying to our MSc. program at the Ruhr-University Bochum is a straightforward process. Please note that the program is highly subsidized and therefore, the tuition fees are very modest. Cost of living in Bochum is low, and the location is very central in Europe.
- Applications should be submitted **no later than the 15th of July!**
- You can **apply online** via the following website:

<https://studium.ruhr-uni-bochum.de/en/application-masters-degree>

Looking forward to seeing you at the RUB!!

Ruhr-Universität Bochum  
Fakultät für Geowissenschaften  
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BOCHUM

RUB



**MSc. IN GEOSCIENCES  
FOCUS ON PETROLOGY  
AND GEOCHEMISTRY**

Ruhr-Universität Bochum, Germany  
Institut of Geology, Mineralogy  
& Geophysics

**PETROLOGY & GEOCHEMISTRY**

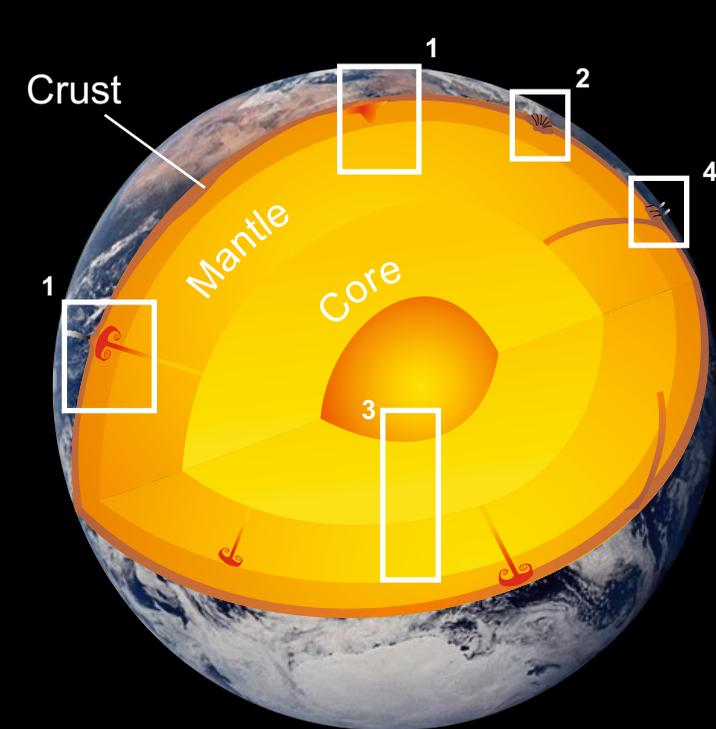
This program aims to provide students with tools based on physico-chemical principles for studying the preserved rock record. A balanced handling of field-, experimental- and theoretical / modelling tools characterizes the program.

**Themes of the program:**

- **Igneous and Metamorphic Petrology** (reconstruction of the details of melting and metamorphic events from field data, chemical analysis and modelling)
- **Physicochemical principles governing the evolution of petrological systems** (For example: equilibrium thermodynamics, kinetics, mineral physics)
- **Geochemistry** (high-temperature stable isotope fractionation processes, trace element partitioning behavior under equilibrium as well as disequilibrium conditions)
- **Experimental- and Analytical Methods in Petrology** (synthesis of geological materials at high pressure and temperature, studying kinetic processes in the laboratory)
- **Numerical modelling** (Calculation of phase equilibria, diffusion processes and fluid flow processes)
- **Strong linkage to Tectonics, Ore Geology, Crystallography, Low temperature geochemistry and Tectonophysics / Geophysics**

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## UNDERSTANDING THE EARTH AND OTHER PLANETARY BODIES



### WHY STUDY PETROLOGY & GEOCHEMISTRY?

**P**etrology and Geochemistry are the science of understanding the origin of rocks. The continental and oceanic crusts, the mantle of the Earth, and other planetary objects such as asteroids, the Moon and Mars are all made up of rocks. These fields aim to understand the formation and evolution of these bodies.

In order to achieve this goal, it is necessary to understand how minerals - the basic units that make up rocks - form and behave. Structure and Properties of minerals and melts are similar in many ways to those of ceramic materials used in various applications. As a result, these fields have often been described as the Materials Science of the Earth's Interior. The methods used in the studies rely strongly on tools from Materials Science and physical chemistry.

Employment opportunities arise in academia and in various Earth and Material Science related industries. Please see our website for a sampling of location of our ex-students (<http://www.gmg.ruhr-uni-bochum.de/petrologie/personal/index.html.de>)

### WHY CHOOSE THE GMG INSTITUTE?

**T**he Institute for Geology, Mineralogy and Geophysics of the Ruhr-University of Bochum is a renowned multidisciplinary teaching and research institution in the field of Earth sciences in Germany. The GMG Institute comprises a diverse faculty with representation in several fields of Earth Sciences including Petrology, Geochemistry, Hydrogeology, Geophysics, Sedimentology, Engineering Geology, Tectonics, Ore Geology, among others. The GMG Institute now offers a full English language MSc. curriculum, making it very attractive to prospective students in Germany and abroad.

### MSc. PROGRAM STRUCTURE

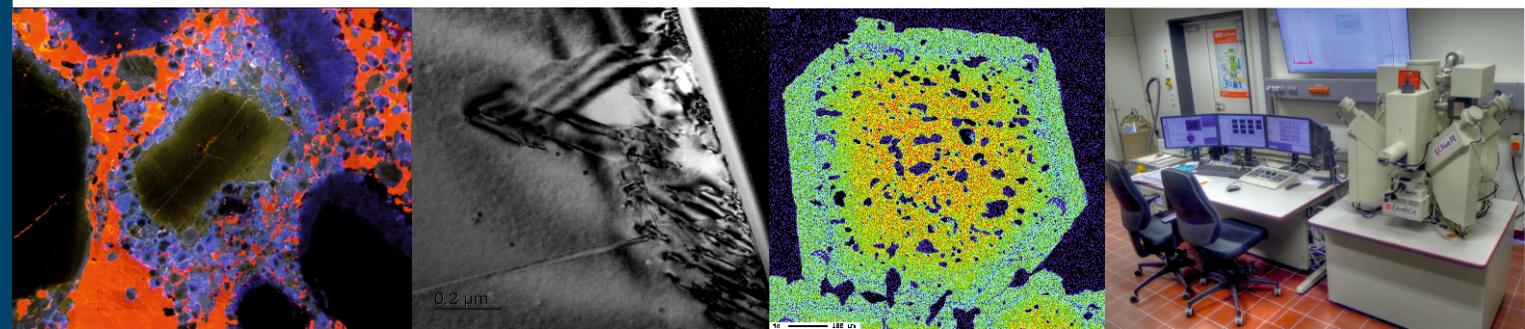
In order to complete the MSc. program in Earth Sciences at the GMG Institute students need to successfully complete:

- Four semesters of modular course work
- One of these semesters is primarily devoted to MSc. research work and writing of a MSc. thesis

### POSSIBLE SELECTION OF COURSE MODULES IN PETROLOGY & GEOCHEMISTRY\*

- Analytical methods in rock analysis (Fockenberg)
- Electron beam microanalysis (Jöns)
- Field course in Petrology (several lecturers)
- Igneous Petrology and Volcanology (Chakraborty)
- High-temperature Geochemistry (Fonseca)
- Kinetics (Chakraborty/Dohmen)
- Metamorphic Petrology (Jöns, Schertl, Dziggel)
- Thermodynamics (Chakraborty)
- Experimental Petrology (Beyer/Fonseca)
- Field course in tectonics and resources (Dziggel)
- Economic Geology (Dziggel)
- Crystal physics and chemistry (Schreuer)
- Structural Geology (Pascal)

\*For more details and a full list of available courses and lecturers please refer to the handbook of the MSc. program in our website at: <http://www.gmg.ruhr-uni-bochum.de/studium/studgang.html.de>



### SOME THEMES THAT ARE CURRENTLY BEING ADDRESSED BY THE FACULTY IN THIS PROGRAM:

#### 1. Melting and crystallization in the Earth:

- How does the Earth's mantle melt?
- How do magmas crystallize?
- How do chemical elements and their isotopes behave during melting and crystallization?
- How to date and characterize ancient melting events using isotope geochemistry?

#### 2. Time scales of crustal building and crustal deformation:

- What can we use to date and constrain the timing of geological processes?
- What are the physical mechanisms of crustal formation?
- How do rocks and minerals change due to deformation?

#### 3. Structure and Mineralogy of the Deep Earth

- How does mantle mineralogy change with depth?
- What is the volatile content of Earth's mantle?
- Does the oxidation state of the Earth change with depth?
- How has the Earth's mantle evolved over time? How are mantle heterogeneities preserved?

#### 4. Crustal recycling in subduction zones

- Do fluids released during subduction affect mantle melting?
- How stable is the oceanic crust during subduction?
- How are subduction fluids involved in ore deposit formation?
- What are the main aspects of crustal deformation and volcanism in subduction zones?
- How did the crust form in the Early Earth?

#### 5. Magmatism in the Moon and other planets

- How are magmatic processes different in the Moon and other planets compared to the Earth?
- How can the study of the Moon bring us insights into how the Earth formed?
- How can isotope geochemistry aid us in understanding planetary formation?