Main purpose of the course Applied petrology is to improve and deepen knowledge on the evolution of crystalline and sedimentary (optional) rocks leading to the formation of Earth’s Crust. Students will be introduced to complex evolution of the Earth’s crust from the Precambrian time to modern days and major rock-forming processes using up-to-date investigation tools and approaches. After the review of major crystalline and sedimentary (optional) rock types and origin, microscopic methods of investigation will be applied, i.e. optical (by polarizing microscopy) and chemical (by scanning electron microscopy) properties of rocks will be studied and implications made on their possible tectonic settings. Thin sections will be examined in order to identify different minerals and rocks under polarizing microscope. Students will learn about Scanning Electron Microscopy (SEM) imaging, X-ray spectrometers, Energy Dispersion Spectrometry (EDS) mapping, X-ray analysis, element and mineral identification, quantitative EDS analysis, sample preparation and specimen handling. Practical application of the SEM to rock samples will help students to acquire practical skills and learn possibilities and limitations of the method. During the laboratory exercises, mineral chemical composition will be measured and mineral species identified.

In the second part of the course, different radiogenic isotopic systems in rocks will be introduced, such as Rb-Sr, Sm-Nd, U-Pb (zircon) and U-Pb-Th (monazite), Lu-Hf, Re-Os etc. Fractionation of masses (isotopes) of the same element, radioactive decay from one element to another, principles of mass spectrometry, application of thermal ionisation mass spectrometry (TIMS), secondary ionisation mass spectrometry (SIMS), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) etc will be studied. Students will learn which isotopic system or several systems can be applied for a particular geological problem, e.g. for age of magmatism or metamorphism, genetic implications, solving different crustal growth problems etc. In case of interest in sedimentary rock formation or modern natural processes, commonly used light stable isotopes such as hydrogen ($^2$H, $^3$H), carbon ($^{13}$C, $^{14}$C) oxygen ($^{17}$O, $^{18}$O), sulphur ($^{33}$S, $^{34}$S, $^{36}$S) etc and their application for environmental studies will be introduced.

After the completion of the course, students will be able:
- understand and explain major rock forming processes through Earth’s history implied from their compositional features; understand how rock composition and properties depend on their origin and tectonic setting;
- understand how isotopic systems evolved through the geological time; relate isotopic abundances and ratios to certain Earth’s crust forming processes;
- choose the most comprehensive and appropriate set of analytical methods in order to identify a rock or imply its evolution; to interpret properly the results of the microscopic and isotopic investigations;
- be able to apply practically some of the methods for a particular scientific problem of rock-forming processes;
- be able to recognize most common types of crystalline and sedimentary (optional) rocks under polarizing (optional) and scanning electron microscope.

Reference list


