MINERALOGY

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Scientific interests: mineralogy of granitic pegmatites and felsic magmatic rocks, fluid and melt inclusions in minerals, fluids in magmatic reservoirs, connection between fluidized magmas, ore formation and volcanism.

Earth and other solid planets are composed of minerals, structurally ordered forms of chemical elements and their compounds. If we understand the structure, composition, and factors that affect the stability of minerals in mineral assemblages (rocks), we can understand the chemistry and physics of major processes occurring within and outside of our home planet. Closer to home, minerals are resources considered as commodities and raw materials. In that case, they form the foundation for many national economies. Moreover, minerals are used in many other areas of human activity: agriculture, food production, jewelry for people and décor for their homes, building, environmental protection etc. Minerals play an important role in many natural reactions controlling the quality of water. One of civilizations achievements is an ability to obtain crystals with specific properties, similar to minerals. All this means that not only geologists, but all educated people, whether they work in science or industry, have to know something about mineralogy and mineral occurrences in the Earth.

The course is focused to teaching students to:
1. Understand how the chemistry of a mineral, its structure and physical properties are related to each other.
2. Macroscopically identify major minerals in hand specimens of common rocks and ores.
3. Become familiar with different instrumental methods of mineral identification.
4. Understand how minerals form in nature and how transition from one mineral assemblage to another affect the chemistry of geological process.

The course has three sections:

1. **Introduction**: Here we go into the basics of mineralogy. The students are expected to be acquainted with general concepts of crystal structure and chemical composition. They will be introduced to the major physical properties of minerals that are used for their identification or for their implication in technological development. This section finishes with a general overview of different methods of mineral identification and scientific research.
2. **The origin of minerals**: Here the major mineral assemblages are considered in the context of the mineral formation process. We are going to conduct students through the major geological processes that result in the formation of specific minerals. Starting with the formation of early minerals in the solar system, mineralogy of meteorites, and the Earth mantle, we follow through the high temperature magmatic, pegmatite, and hydrothermal mineral formation and we will finish with the low temperature crystallization of minerals in shallow hydrothermal and surficial environments. Each process will be attributed to specific mineral assemblages. The minerals in some sense resemble living things, forming families and communities. Some of them can easily form together and occur in one assemblage, while others can never be found among the products of one process. Thus, mineral assemblages keep key information on the physical and chemical parameters of geological processes.

3. **Systematic mineralogy**: This section is the major part of the course and brings together all the information provided in the previous course sections. Minerals are primarily chemical substances and therefore they are considered in the scope of chemical systematics. There are approximately 5600 – 5800 known mineral species, with dozens to hundreds more discovered every year. We will study in detail 50 to 60 known minerals, in relation to their chemical composition, structure, occurrence, and their economic and scientific significance. All of them belong to major rock and ore forming minerals. Students will be expected to recognize them and identify them macroscopically and to know their implications for technologies and reconstruction of geological processes.

The major focus of the laboratory practice will be on macroscopic identification of minerals and recognition of mineral assemblages. However, identification is not the end in itself. The minerals in assemblage always tell a story. The aim of the practice is not only to teach f recognizing minerals but also to read these stories and try to understand general information about the geological processes that formed them.

In the laboratory practice, students will be asked to examine collections of 5-10 samples and provide full macroscopic identification without supervision. There will also be a set of quizzes in the lab and 'take home' tests to help them master the material.

Students that successfully complete all course assignments and pass the final exam will be armed with the powerful instruments needed to conquer

the challenges that nature poses for geology professionals in the field and laboratory study of minerals, rocks, and ores.