ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

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Basic Information:
Course Title: MINERALS AS INDICATORS OF MAGMATIC AND METAMORPHIC PROCESSES

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Total Teaching Hours: 30

Annotation (up to 150 words)

The course is addressed to mineralogists, petrologists, sedimentologists and other specialists, working in the field of the Earth Sciences. The course aims to introduce the PhD students with the possibilities and perspectives of application of the indicative properties (chemical composition, structural state, habitus, structural, chemical and phase inhomogeneity, etc.) of accessory minerals (magnetite, ilmenite, monazite, xenotime, zircon, allanite, etc.) from igneous and metamorphic rocks for assessment of the genesis and physicochemical conditions of crystallization and alteration of the host rocks. Special attention will be paid to the methods and approaches for extraction and identification of accessory minerals and to the methods commonly applied for investigation of the indicative properties of the minerals as optical microscopy, electron microscopy (SEM, TEM, electron probe microanalysis), vibration spectroscopy (Raman and IR).

Course content (brief description by topics or modules)
Topic / Module 1: General characteristics of accessory minerals. Types of accessory minerals (magnetite, ilmenite, monazite, xenotime, zircon, allanite, etc.) in intrusive and metamorphic rocks. Indicator properties (chemical composition, structural state, habit, structural, chemical and phase heterogeneity, etc.) for assessing the genesis and conditions of crystallization and secondary alteration of the host intrusive and metamorphic rocks. Rare earth elements in the magmatic process: geochemical behavior, distribution coefficients, mineral carriers.
Topic / Module 2: Methods of studying accessory minerals 1. Methods for extraction and identification of accessory minerals in heavy mineral fractions of river sediments and intrusive and magmatic rocks.

Sample preparation of accessory minerals for specialized studies (scanning electron microscopy and electron probe microanalysis; backscattered electron diffraction; vibrational spectroscopy; inductively coupled plasma and laser ablation mass spectrometry; and other methods).
Topic / Module 3: Methods of studying accessory minerals 2. Scanning electron microscopy, electron probe microanalysis and backscattered electron diffraction. Morphology, elemental composition, chemical, phase and structural heterogeneities of accessory minerals and their genetic significance. Vibrational spectroscopy (infrared and Raman spectroscopy. Phase identification, structural disorder. Examples from the study of monazites and zircons.

Teaching and assessment methods
Lectures – 20 hours.
Practical training – 10 hours
Assessment – oral examination

Competencies acquired as a result of training (3–5 points)

1. Accessory mineralogy. Geochemistry of rare earth elements.
2. Modern methods of studying accessory and main minerals

Literature:

Костов, И. 1993. Минералогия. С., Техника, 734 с.

Костов, И. 1978. Кристалография. С., Наука и изкуство, 447 с.

Каменов, Б. 2003. Магматична петрология. София, Университетско издание „Св. Климент Охридски“, 872 с.

Phosphates: Geochemical, Geobiological, and Materilas Importance. 2002. (M.J. Kohn, J. Rakovan, J.M. Hughes, Eds).2002. Reviews in Mineralogy and Geochemistry, Vol.48

Reed, S. J. B. 2005. ELECTRON MICROPROBE ANALYSIS AND SCANNING ELECTRON MICROSCOPY IN GEOLOGY, 232 p.

Additional information (optional) (e.g., special requirements, laboratory equipment, prior knowledge)

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