ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

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Basic Information:
Course Title: Palaeomagnetism
Lecturer: corr. member of BAS, DSc prof. Daniela (Neli) Jordanova
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Email: vanedi@geophys.bas.bg
Total Teaching Hours: 30 hours lectures + 15 hours laboratory exercises

Annotation (up to 150 words)

The course is intended for PhD students in the field of Earth Sciences who are dealing with problems of geological and tectonic evolution, paleogeographic reconstructions and dating methods in geology. Paleomagnetism is a relative dating method widely used in geology, geophysics and archaeology. The main goal of paleomagnetism is the reconstruction of the elements of the Earth's magnetic field in the geological past. Only through the paleomagnetic data can theories of the magnetic geodynamo (periods, frequency of inversions) be verified, refined and developed; global geological problems (continental drift) be solved; and the sequence of tectonic processes and movements on a regional scale be analyzed. The course covers the basics of rock magnetism, methodology of conducting paleomagnetic studies, and a number of examples of solving specific problems in geophysics, geology, paleogeography, and archaeology related to the use of paleomagnetic data. Doctoral students have the opportunity to acquire practical skills for conducting paleomagnetic studies through laboratory measurements of rocks and sediments.

Course content (brief description by topics or modules)
Topic / Module 1: Domain structure of the solids. Magnetization processes in ferromagnetic minerals. Superparamagnetic particles. Relaxation time.
Topic / Module 2: Types of Remanent magnetizations in ferrominerals and rocks.
Topic / Module 3: Palaeomagnetism – main concepts, methods and applications
Topic / Module 4: Magnetic properties of the main ferromagnetic Fe-containing minerals in natural materials.
Topic / Module 5: Anisotropy of magnetic susceptibility (AMS). Definition of the AMS ellipsoid, anisotropy parameters and applications of the method.
Topic / Module 6: Reconstructions of plate tectonics using palaeomagnetic data.
Topic / Module 7: Palaeomagnetic dating method.
Topic / Module 6: Application of magnetic properties of natural and anthropogenically influenced materials in investigations of archaeological sites.

Teaching and assessment methods
Lectures and/or consultations – 30 hours
Exercises – 15 hours in the Paleomagnetic Laboratory of the National Institute of Geophysics
Assessment: written exam and interview

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

Basic knowledge of the method of paleomagnetic dating of rocks - specifics of sample collection, advantages and disadvantages

Skills for analyzing paleomagnetic data

Practical skills for working with specialized equipment for paleomagnetic research

Literature:

Butler, R. 1998. Paleomagnetism: magnetic domains to geologic terranes. Electronic edition

Dunlop, D. and O.Özdemir, 1997. Rock Magnetism. Fundamentals and frontiers, (D. Edwards, ed.), Cambridge Studies in Magnetism, Cambridge University Press.

Merrill R.T. and McElhinny, M. 1983. The Earth’s magnetic field. Its history, origin and planetary prespective. Academic Press.

Chikazumi, S. 2010. Physics of Ferromagnetism. Second Edition. Oxford Univ. Press.

Collinson, D. W., 1983. Methods in Rock Magnetism and Palaeomagnetism. London, New York, Champman and Hall.

Evans, M. and F.Heller, 2003. Environmental Magnetism. Principles and Applications of Enviromagnetics. Academic Press, California, USA.

Jordanova, N., Jordanova, D., Kostadinova-Avramova, M., 2024. Synergy of environmental magnetism and archaeomagnetism for the benefit of archaeology - state of the art in Bulgaria. In: WORLD ARCHAEO-GEOPHYSICS: Integrated minimally invasive approaches using country-based examples. Eds: C. Cuenca-Garcia, A. Asandulesei, K.Lowe. Springer Intern. Publ., ISBN-13: 9783031578991, Series: One World Archaeology, 65 – 89.

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