

ADVANCED ORE MINERALOGY AND ORE MICROSCOPY

Content (10 study credits): Detailed ore mineralogical investigation, whether for the purposes of understanding how and why a given deposit has formed, to ascertain the possible economic value of the deposit, and to evaluate optimal methods for its exploitation, is a critical part of any study of an ore deposit.

This course will give students the opportunity to learn about contemporary methods of ore investigation, and how they can be applied to different types of ore deposits. Particular emphasis will be placed on deposits of the base and precious metals. Strong focus will be given throughout the course to worked case examples, the integration of current research ideas, and encouraging the student to become both proficient and confident with mineral identification, and interpretation of ores.

Goals: The laboratory classes will focus on the identification and interpretation of ore mineral associations and textures using the reflected light microscope. Some 100 minerals will be introduced, from simple sulphide and oxide minerals, to common and less common accessories of gold and gold-silver ores. Sample material will come from deposits in Norway and the instructor's collection of polished ore specimens from selected base and precious metal ores from around the world.

Previous course requirements/restrictions: None

This course builds on: GEL2110 (Mineralogy, petrology and geochemistry), GEO4810 (Optical mineralogy), new course in mineral resources (recommended). A good understanding of (i) mineralogy and petrology, (ii) the basic principles of geochemistry and (iii) English language (oral and written) are further requirements.

Teaching format and regularity:

The course will be given as a 2-week intensive course, with each of the 10 days consisting of 3.5 hours of lectures and a 3.5-hour laboratory exercise. Language: English

Exams: Oral (55% of total mark), plus 3 laboratory exercises (each counting 15% of total mark). The final mark will be given against the background of an overall evaluation of the students performance in all areas of the course.

Course description:

Topics to be covered in the course are:

1. Introduction to ore mineralogy, what will we study and why?
2. Applications of ore mineralogy in ore deposits studies; other applications
3. Review of the reflected light microscope; basic principles and techniques of investigation
4. Other investigative methods (SEM, microprobe, etc.).
5. Selection and preparation of polished blocks for microscopic study
6. Principal characteristics of ore minerals and identification criteria
7. Ore mineral assemblages, paragenetic studies. How to describe ores. Textural aspects of the main types of ores
8. Ore petrography: Using ore textures as a petrogenetic tool, recognition of crystallization sequences, processes of decomposition, exsolution, replacement and metamorphic overprinting, principles of eutectic crystallization, chemical equilibrium, diffusion, etc.
9. The mineralogy of 'simple' base metal sulphide ores. Mineralogical distribution of metals, the mineralogy of 'simple' sulphide ores
10. Liquid magmatic Cu-Ni deposits – mineralogy and textures
11. Massive sulphide Cu-, Cu-Zn- and Zn-Pb ores – mineralogy and textures in volcanogenic and sedimentary-exhalative ores
12. The concept and expression of ore remobilization/recrystallization
13. Distribution of precious metals in massive sulphide ores

14. Gold-(silver) deposits – types of deposits and their mineralogy; gold mineralogy; visible and invisible gold, ore characterization; gold deposits as seen under the microscope - identifying redox boundaries; epithermal gold deposits; magmatic-hydrothermal deposits (porphyry, skarn, etc.); orogenic 'lode' gold deposits; iron-oxide-Cu-Au deposits; placer gold deposits; gold-telluride ore deposits – mineralogical controls ; gold enrichment processes (the role of polysulfide melts and gold scavengers, etc.); case studies of selected gold deposits
15. The ore mineralogy of other deposit types (PGE deposits, Sn-W deposits, etc.)
16. Trace mineralogy; the usefulness of trace minerals as petrogenetic tools; complex sulphides and sulphosalts; principles of sulphosalt systematics, case examples on selected sulphosalt mineral groups; telluride minerals, overview of mineralogy, gold and gold-silver tellurides, bismuth tellurides

Examination requirements (individual learning): Lecture notes specific to the course will be prepared for distribution (on CD).

Introduction to Ore-Forming Processes (Robb, L.) Oxford (Blackwell Publishing). 2004, 373 pp. £32.50. ISBN 0-63206-378-5.

Ore Microscopy and Ore Petrography (Craig, J.R., Vaughan, D.J.) 2nd edition 1994, John Wiley, 434 pp. ISBN 0-471-11599-1 (currently out-of-print??)

Instructors:

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