



MINERAL RESOURCES

Prof. Eric PIRARD

Work load: 30h Theory (lectures), 1 day field work, 30h Practice (lab), 32h Project work.

Number of credits: 5 ECTS

Course code: GEOL0020-7

Source: <http://www.emerald.ulg.ac.be/?q=mineral-resources>

► *Course contents:*

- General overview of the mineral resources sector.
- Definitions of ore, resource, reserve (JORC Code).
- Mineral production and consumption statistics.
- General concepts of metallogeny
- Economic Geology of:
 - Deposits related to magmatic activities;
 - Deposits related to hydrothermalism associated to magmas;
 - Hydrothermal deposits related to sedimentary /structural features;
 - Deposits formed in sedimentary/evaporitic environments;
 - Detrital deposits;
 - Deposits formed by superficial weathering;
 - Deposits linked to metasomatism, metamorphism, diagenesis

► *Intended Learning Outcomes:*

- Understand the diversity and complexity of the geological contexts of the main metallic ore deposits.
- Be able to imagine the best exploration tools criteria for each kind of mineral resource
- Be able to establish a clear link between the ore deposit type (nature) and the most appropriate excavation technique (engineering) to optimize resources
- Understand the geopolitical context prevailing for each metallic resource and suggest possible actions to mitigate EU and regional critical dependency.
- Plan a resource exploitation strategy to lower the impact of geological and mineralogical characteristics on the downstream mineral processing
- Be able to gather information and communicate to the wider society the challenges of extracting resources in complex natural environments
- Have the right background in economic geology to be a creative partner in an environmental remediation team



► *Prerequisites and co-requisites:*

General geology

► *Planned learning activities and teaching methods:*

Lectures are delivered in a classroom allowing for spontaneous interaction between professor and students. These lessons use PPT enriched with video presentations and remote sensing images to introduce the environmental and social issues faced by the mining sector.

Every (2h) lecture is complemented by a (2h) practical session, inviting students to manipulate and observe real samples, to question researchers and to search for professional literature. Students are initiated to ore microscopy to apprehend the complex texture and mineralogy of natural resources. A collection of more than 5000 samples from all over the world is available for browsing through the variety of world deposits.

Groups of two students with different backgrounds/culture are formed. Each group is asked to gather and synthesize scientific and commercial literature referring to a given world class deposit currently being exploited. A poster session is organized at the end of the course to allow for interaction and peer-evaluation among students.

► *Mode of delivery (face-to-face; distance-learning):*

Frontal instruction (2h) to explain the geological context of each deposit

Hands-on learning (2h) to manipulate samples and observe them under the microscope

Face-to-face discussions and interaction with young researchers in the field

Cooperative learning including team work, realization and presentation (pitch) of a poster in front of peers

► *Recommended or required readings:*

Required:

Power Point presentations available through the student portal (MyULg)

ARNDT N., GANINO CI, KESLER St. - Metals and Society - An Introduction to Economic Geology, Springer, 2012

Recommended:

IIED, Breaking New Ground: Mining, Minerals and Sustainable Development (final report of the International Institute for Environment and Development).

ROBB L. - Introduction to ore-forming processes - Blackwell, 2009



► *Assessment methods and criteria:*

Written examination (75%): One major question relating to the mechanism of ore deposit formation and insisting on the features (size, grade, geometry, host rocks, etc.) that will impact the exploitation technique and the environment.

A series of more specific questions related to the terminology, the mineralogy and grades of various elements, the main producing regions of the world, etc.

The scientific rigor, clear structure and illustration as well as care taken in the presentation are essential criteria in the evaluation

Oral examination (15%): Identification of ore samples using both microscopic and macroscopic techniques. Interactive discussion on mineralogy, deposit type and main features of the mineralisation.

Poster and pitch presentation (10%): Overall quality of the poster (structure, illustration, sources,...) and clarity of the oral presentation.

► *Contribution to EIT's Overarching Learning Outcomes:*

OLO 1 : Sourcing of raw materials questions sustainability. In this course, students learn where to find the different resources needed by our technologies, they are well aware of the limits and impacts of mining these resources (ex. the energetic value of aluminium; the link between fiber optics and coal through germanium,...). They are able to decide between sourcing primary (mining) and secondary (recycling) resources

OLO5/OLO6/OLO 7: Students spend 50% of their time working in the lab and manipulating ores. They are initiated to documentary research and are invited to synthesize and present (poster + oral) the result of their team work (group of two).