APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOL 201
School of Science
Fall, 2018

COURSE OUTLINE

GEOL201

ORE DEPOSITS

3 **CREDITS**

PREPARED BY: Joel Cubley, Coordinator DATE: June 1, 2018

APPROVED BY: Margaret Dumkee, Dean DATE: June 1, 2018

APPROVED BY ACADEMIC COUNCIL: May 2014

The Course Outline Template is approved by the Academic Council on June 20, 2018

ORE DEPOSITS

INSTRUCTOR: Siobhan McGoldrick, M.Sc.

OFFICE LOCATION: M105

E-MAIL: smcgoldrick@yukoncollege.yk.ca

TELEPHONE: (867) 456-8605

OFFICE HOURS: F (2:30-4:30 p.m.)

CLASSROOM: M111 (lecture)
T1090 (laboratory)

TIME: T/Th 10:30 am-12:00 pm (lec.)
W 1-4 pm (lab.)

DATES: Sept. 5 – Dec. 20, 2018

COURSE DESCRIPTION

Geology 201 provides introduction to the classification, distribution, and characteristics of metalliferous ore deposits, as well as diamonds. A focus is put on the classification of ores based on their petrologic association and current models for ore deposit genesis. The tectonic settings of ore deposits are considered within the context of the plate tectonic paradigm and global metallogenic events throughout Earth's history. Laboratory classes will examine sample sets from across Canada, with an emphasis on northern deposits. Students will receive an introduction to reflected light optical microscopy techniques, and blend hand sample, drill core and thin section petrography to best characterize mineralized samples.

PREREQUISITES

GEOL110 (Mineralogy/Petrology) OR by permission from the instructor.

EQUIVALENCY OR TRANSFERABILITY

University of British Columbia – EOSC 220 (3)
University of Northern British Columbia – ENSC 1XX (3)
University of Victoria – EOS 205 (1.5)
Vancouver Island University – GEOL 1XX (3)

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to

- Recognize and describe different styles of mineralization and associated alteration in rock specimens and thin sections
- Describe the characteristic mineralogical, structural and host-rock features of a

range of important ore deposit types

- Explain the current hypotheses for the genesis of a range of ore deposit types
- Combine scientific data to form a hypothesis that can be used in mineral exploration for a range of ore deposit types
- Identify common ore minerals in both hand and diamond drill core samples, and define the chemical components of those minerals.

COURSE FORMAT

This course consists of two 90-minute lectures and one 3-hour lab period per week. The schedule included in this course outline details the major topics covered and when those topics will be presented throughout the course. Laboratory exercises will be conducted in both classroom and field settings. Most laboratory exercises will be conducted at the Yukon Geological Survey in order to utilize the MINFILE and diamond drill core collections housed at the H.S. Bostock Core Library.

ASSESSMENTS

Attendance & Participation

Students are strongly encouraged to attend all lectures and laboratory exercises. Lab exercises can be completed only during lab periods and materials may not be available outside these hours. Off-campus field exercises must be completed during the allocated time with the instructor present.

Assignments

GEOL 201 (Ore Deposits) is a hands-on course with lectures built around the laboratory exercises. The majority of the learning is experiential and occurs in the lab. Characteristics of each major ore deposit type are examined through the study of representative suites. The weekly labs are due at the start of the next week's lab period. In addition to the lab exercises, students will complete 4 lecture assignments over the course of the semester to help reinforce critical concepts.

Students should complete textbook readings in support of lecture presentations to achieve the best possible educational outcome. Textbook readings will require 1-2 hours of time outside of class each week. The laboratory and/or lecture assignments will require an extra 2-4 hours of time.

Tests

There will be midterm and final lecture exams, as well as a final laboratory exam. Students must pass the lecture final examination to achieve an overall passing grade.

Due Dates

Lecture assignments are due at the start of lecture on the date assigned by the instructor. Laboratory assignments will be due at the start of the following laboratory period unless otherwise indicated by the instructor. Late assignments will be graded based on the following scheme: a deduction of 10% per day up until a total deduction of 50% is reached, following that, assignments must be submitted prior to the date that the instructor hands back the graded assignment (set by the instructor), unless otherwise indicated by the instructor.

Missed exams will be assigned a grade of 0% unless re-scheduling for a valid reason is approved and determined **in advance** of scheduled exam date. If there are known conflicts with exam scheduling, please see the instructor as soon as possible to discuss an alternative examination date.

EVALUATION

Tests and Assignments	***Weight***	***Dates***
Weekly Lab Assignments	40% (4% each)	Due at the start of each subsequent lab section.
Lecture Midterm Exam	10%	During lecture class time in late
Lab Final Exam	20%	During scheduled lab time in the final week of classes.
Lecture Final Exam	20%	During exam period, as scheduled by registrar.
Lecture Assignments	10% (2.5% each)	During lecture class time at regular intervals throughout the
Total	100%	

REQUIRED TEXTBOOKS AND MATERIALS

Required textbook
Ridley, J. (2013). *Ore Deposit Geology* (1st ed.). Cambridge, UK: Cambridge University Press. 353 p.

Recommended textbook (on reserve in the library)
Robb, L. (2005). *Introduction to Ore-Forming Processes* (1st ed.). Oxford, UK. Blackwell Publishing. 373 p.

ACADEMIC AND STUDENT CONDUCT

Information on academic standing and student rights and responsibilities can be found in the current Academic Regulations that are posted on the Student Services/ Admissions & Registration web page.

PLAGIARISM

Plagiarism is a serious academic offence. Plagiarism occurs when a student submits work for credit that includes the words, ideas, or data of others, without citing the source from which the material is taken. Plagiarism can be the deliberate use of a whole piece of work, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Students may use sources which are public domain or licensed under Creative Commons; however, academic documentation standards must still be followed. Except with explicit permission of the instructor, resubmitting work which has previously received credit is also considered plagiarism. Students who plagiarize material for assignments will receive a mark of zero (F) on the assignment and may fail the course. Plagiarism may also result in dismissal from a program of study or the College.

YUKON FIRST NATIONS CORE COMPETENCY

Yukon College recognizes that a greater understanding and awareness of Yukon First Nations history, culture and journey towards self-determination will help to build positive relationships among all Yukon citizens. As a result, to graduate from ANY Yukon College program, you will be required to achieve core competency in knowledge of Yukon First Nations. For details, please see www.yukoncollege.yk.ca/yfnccr.

ACADEMIC ACCOMMODATION

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this class. These accommodations are available for students with a documented disability, chronic condition or any other grounds specified in section 8.0 of the Yukon College Academic Regulations (available on the Yukon College website). It is the student's responsibility to seek these accommodations. If a student requires an academic accommodation, he/she should contact the Learning Assistance Centre (LAC) at (867) 456-8629 or lac@yukoncollege.yk.ca.

THE LORENE ROBERTSON WRITING CENTRE

All students are encouraged to make the Writing Centre a regular part of the writing process for coursework. The Lorene Robertson Writing Centre is staffed by helpful writing coaches from across the College and offers one-on-one appointments to students in need of writing support.

The Lorene Robertson Writing Centre can help you:

- Get started on an assignment and focus your ideas
- Outline and plan your assignment
- Write clearly, logically and effectively
- Address specific needs and writing problems
- Revise the first and final drafts of your project
- Gain confidence in your writing

For in-person appointments, the Centre coaching office is located in the Academic Support Centre in room A2302. You can also participate in coaching appointments over the phone or online. see the Academic Support Centre schedule for English and writing support times.

TOPIC OUTLINE

Module	Topics	Recommended Readings
1	Introduction • Definition of ore • Economic factors affecting the exploitation of ore • Resources versus resources • Ores as concentrations; first-order concentration mechanisms.	Ridley Ch. 1 (p. 1-20) Robb Introduction (p. 1-11)
2	Igneous ore-forming processes • Metallogeny of oceanic and continental crust • Fundamental magma types and their metal endowment • Relative fertility of magmas and the "inheritance factor" • Partial melting and crystal fractionation in ore formation • Trace element distribution during partial melting • Trace element distribution during fractional crystallization • Chromite deposits and liquid immiscibility • Layered mafic intrusions	Ridley Ch. 2 (p. 20-91) Robb Ch. 1 (p. 19-90)
3	Magmatic-hydrothermal ore-forming processes • Physical and chemical properties of water • Magmatic-hydrothermal fluids • Pegmatites and their significance • Metal transport in magmatic-hydrothermal fluids • Water content and depth of emplacement of granitic magmas • Fluid flow in and around granitoid intrusions	Ridley Ch. 3 (Sections 3.1-3.2; p. 92 – 199) Robb Ch. 2 (p. 75-126)

	• Origin of porphyry (Cu, W, Mo) deposits • Polymetallic skarn deposits • Epithermal Au-Ag-(Cu) deposits • Role of fluids in mineralized mafic rocks	
4	Hydrothermal ore-forming processes • Origin of fluids in the crust • Deformation, pressure gradients and hydrothermal fluid flow • Syn-orogenic hydrothermal ore deposits (Carlin, orogenic gold, IOCG, etc.) • Metal solubilities in aqueous solutions • Fluid-rock interactions and alteration • Precipitation mechanisms • Metal zoning and paragenetic sequences • Modern analogues for hydrothermal ore-forming processes • Ore deposits associated with aqueo-carbonic hydrothermal fluids • Ore deposits associated with connate fluids • Ore deposits associated with meteoric fluids	Ridley Ch. 3 (Section 3.3, p. 199 – 240) Ridley Ch. 4 (p. 241 – 286) Robb Ch. 3 (p. 130-215)
5	Surficial and supergene ore-forming processes • Principles of chemical weathering • Formation of lateritic soil/regolith profiles • Bauxite ore formation • Nickel, Gold, and PGE in laterites • Clay deposits • Calcretes and surficial uranium deposits • Supergene enrichment of copper and other metals	Ridley Ch. 5 (290 – 306) Ridley Ch. 6 (p. 337 – 356) Robb Ch. 4 (p. 219-245)
6	Sedimentary ore-forming processes • Sedimentary basins and their tectonic settings • Clastic sedimentation and heavy mineral concentrations • Chemical sedimentation and ore formation	Ridley Ch. 6 (p. 307-334) Robb Ch. 5 (p. 246-286)

7	Ore deposits in a global tectonic complex	Robb Ch. 6 (311-344)

	• Patterns in the distribution of mineral deposits • Continental growth rates • Crustal evolution and metallogenesis • Metallogeny through time • Plate tectonics and ore deposits summary	

Tentative laboratory schedule

Week	Topic
1	Identifying ore minerals in hand sample
2	Ni-Cu-PGE deposits in hand sample (Coleman mine, Sudbury, ON)
3	Introduction to core logging and description using magmatic Ni-Cu-PGE deposits (Wellgreen deposit, YT)
4	Cu-Au porphyry deposits (Casino and Minto deposits, YT)
5-6	Open-Pit Skarn Mapping Project (Arctic Chief deposit, YT)
7	High-sulfidation epithermal deposits **(**Dickson Hill Property, YT)
8	Core geoteching, measuring oriented structures in drill core
9	Volcanic-hosted massive sulphide (VHMS) deposits (Fyre Lake & Wolverine deposits, YT)
10	Sedimentary exhalative (SEDEX) deposits (Mel Property, YT)