APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOL 206
3 Credit Course
Fall, 2021

COURSE OUTLINE

GEOL 206

SEDIMENTOLOGY AND STRATIGRAPHY

3 CREDITS

PREPARED BY: Joel Cubley, Instructor/Coordinator, Earth Sciences
DATE: February 18, 2020

APPROVED BY: Stephen Mooney, Acting Dean, Applied Science & Management
DATE: March 2, 2020

APPROVED BY ACADEMIC COUNCIL: March 11, 2020
RENEWED BY ACADEMIC COUNCIL: Click or tap to enter a date

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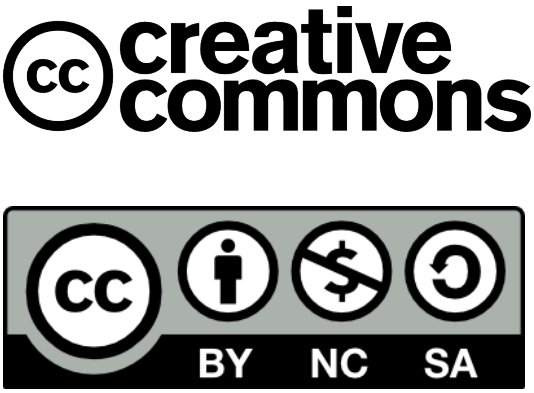

Version 1.2 revised and approved by Academic Council: April 17, 2019
Academic Council, Governance Office
Academic Council MyYC: Policies, Procedures and Forms

APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOL 206
3 Credit Course
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SEDIMENTOLOGY AND STRATIGRAPHY

INSTRUCTOR:	**OFFICE HOURS:**
OFFICE LOCATION:	**CLASSROOM:**
E-MAIL:	**TIME:**
TELEPHONE:	**DATES:**

COURSE DESCRIPTION

This course provides a comprehensive introduction to the fields of sedimentology and stratigraphy. Students examine the physical and chemical processes that govern sediment production, transport, and deposition in a variety of environments, and gain expertise in the identification and classification of sediments and sedimentary rocks using various classification schemes. The course also introduces different principles and methods for stratigraphic analysis and correlation. Students incorporate these methods with sedimentological data and observations to describe and interpret sedimentary facies, predict facies architecture, and resolve depositional histories. Students learn associations between tectonic settings and depositional facies, and the tectonic controls on the development of sedimentary basins are presented with a focus on basin development in Yukon and Western Canada.

PREREQUISITES

Successful completion of GEOL 105 (Physical Geology) and GEOL 106 (Historical Geology), or permission from the course instructor. Mineralogy (GEOL 200) must be previously completed or be taken as a co-requisite in the same term. Prior completion of GEOL 107 (Geological Field Methods and Mapping I) is an asset.

EQUIVALENCY OR TRANSFERABILITY

This course has been recently re-developed, and its transferability is still being evaluated. Receiving institutions always determine course transferability. Further information and assistance with transfers may be available from the School of Science.

LEARNING OUTCOMES

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

- analyze and characterize the physical processes responsible for sediment production, transport, deposition and lithification.
- properly classify, describe and interpret sedimentary rocks in outcrop, hand sample, and thin section; accurately measure and record stratigraphic sections in a field setting.
- identify and interpret physical and biogenic sedimentary structures.
- predict what types of sedimentary processes and depositional environments would characterize a particular tectonic setting, and what the resulting stratigraphic signature would be.
- interpret changes in a depositional environment through time (stratigraphic change) at a variety of spatial and temporal scales based on data from sedimentary rocks and successions.
- utilize different analytical methods and datasets (lithostratigraphy, chronostratigraphy, chemostratigraphy, magnetostratigraphy, etc.) to build and correlate stratigraphic sections.
- demonstrate understanding of the facies concept and be able to use facies associations and facies models to interpret depositional environments.

COURSE FORMAT

This course consists of two 90-minute lectures and one three-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. Lab exercises will be conducted in classroom, computer lab and field settings.

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
Weekly lab exercises (10) will be due at the start of the following lab session unless otherwise indicated by the lab instructor. Two lab exercises will require a formal report-style write-up, with requirements clearly outlined during the laboratory period. Four additional take-home lecture assignments will be assigned at regular intervals over the course of the semester.

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).

Tests
There will be three exams in this course: a midterm lecture exam, a final lab exam and a final lecture exam. The midterm lecture and final lab exams will be held during regular lecture or laboratory sections; the final lecture exam is scheduled by the Office of the Registrar.

EVALUATION:

Weekly Lab Assignments	35% (8 labs @ 3%, 2 labs @5.5%)
Midterm Exam	15%
Final Lab Exam	20%
Final Lecture Exam	20%
Lecture Assignments	10% (4 assignments @ 2.5% each)
Total	100%

REQUIRED TEXTBOOKS AND MATERIAL
Boggs S. 2012. Principles of sedimentology and stratigraphy. 5th ed. Upper Saddle River (NJ): Pearson. 600 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): lac@yukoncollege.yk.ca.

TOPIC OUTLINE

Module	Topics
1	**Introduction to stratigraphy and sedimentary structures** • *Course overview*: historical development of sedimentary geology, basic concepts, types of stratigraphy • *Preliminary classification and analysis*: classification schemes, common textures and sedimentary structures, methods of analysis • *Characteristics of fluid flow and particle motion:* laminar vs. turbulent flow; Stoke's law; Hjulstrom curves; particle transport
2	**Clastic sedimentary rocks and their depositional environments** • *Overview of clastic sedimentary rocks and their formation:* sandstones, conglomerates, shales, etc.; sediment provenance and diagenesis • *Terrestrial depositional environments of clastic sedimentary rocks:* fluvial, colluvial, aeolian, lacustrine and glacial environments • *Marginal-marine environments*: deltaic, beach and barrier island, estuarine, lagoonal and tidal-flat environments • *Siliciclastic marine environments*: physiography and depositional settings of shelves; transport, depositional processes and sediment types in deep-ocean environments
3	**Biochemical rocks and their depositional environments** • *Overview of biochemical sedimentary rocks:* chemistry and mineralogy, textures of limestone and dolomite, structures and classification of carbonate rocks, origin and diagenesis of carbonate rocks • *Depositional environments of biochemical sedimentary rocks:* carbonate shelves, slopes/basins, organic reef environments, mixed carbonate-siliciclastic systems
4	**Chemical and non-epiclastic sedimentary rocks and their depositional environments**

	• *Overview of chemical and non-epiclastic sedimentary rocks*: evaporites, siliceous sedimentary rocks (cherts), iron-bearing sedimentary rocks, sedimentary phosphorites, carbonaceous sedimentary rock (coal, oil shale, bitumens)
5	**Organization of stratigraphic record; stratigraphic units and code** • *Organization of stratigraphic record, stratigraphic units and code:* geologic time, stratigraphic units, International Stratigraphic Guide, North American Stratigraphic Code
6	**Geochronology in sedimentary environments (chronostratigraphy)** • *Geochronology in sedimentary environments*: chronostratigraphy, calibration of the geologic time scale, introduction to radiochronology, event correlation and event stratigraphy
7	**Lithostratigraphy and sedimentary facies** • *Lithostratigraphy and sedimentary facies:* types and descriptions of lithostratigraphic units, lithostratigraphy and depositional environments, lithocorrelation, facies analysis and facies associations
8	**Biostratigraphy and chemostratigraphy** • *Biostratigraphy:* history, biostratigraphic units, biostratigraphic zonation, biocorrelation • *Chemostratigraphy*: correlation by stable isotopes, detrital zircons, tephrochronology
9	**Magnetostratigraphy, seismic and sequence stratigraphy** • *Magnetostratigraphy:* general principles, sampling, measuring and displaying remnant magnetism, magnetic polarity time scales, terminology and applications of magnetostratigraphy and paleomagnetic studies • *Seismic stratigraphy:* principles of reflection seismic methods, application of reflection seismic methods to stratigraphic analysis • *Sequence stratigraphy:* fundamentals of sequence stratigraphy, methods and applications
10	**Tectonics and sedimentation** • *Tectonics and sedimentation:* plate tectonics and basins, types of sedimentary basins (divergent, intraplate, convergent, transform and hybrid settings)

11	**Basin analysis and characterization** • *Basin analysis and characterization:* mechanisms of basin formation, techniques and applications of basin analysis
12	**Hydrocarbon development and stratigraphic controls** • *Hydrocarbon development and stratigraphic controls:* source rocks, formation, transport and traps for petroleum; conventional and unconventional extraction techniques
13	**Western Canada case studies** • *Geology of the Western Canada Sedimentary Basin:* geologic setting and history, oil, gas and bitumen resources of the WCSB • *Hydrocarbon resources in the Yukon:* geologic setting and history of Yukon basins; oil and gas resources in the Yukon. • *Sedimentology of Yukon placer gold deposits:* depositional history, sedimentary stratigraphy of the Klondike district; gold remobilization and transport

LABORATORY OUTLINE

Week	Topic
1	Sedimentary grain size analysis of neoglacial sediments from Schwatka Lake
2	Sedimentary rock descriptions and quantitative measurements; Richtofen Fm., Whitehorse Trough [afternoon field trip]
3	Measuring and constructing stratigraphic sections for future correlation exercises; Tanglefoot and Tantalus Fms., Carmacks [full day field trip]
4	Siliciclastic sedimentary rocks: description and classification from hand sample and thin section analysis
5	Carbonate sedimentary rocks: description and classification from hand sample and thin section analysis
6	Chemical and non-epiclastic sedimentary rocks: description and classification from hand sample and thin section analysis
7	Lithostratigraphic correlation: lateral migration of facies during transgressive/regressive sequences; lithostratigraphic correlations between multiple stratigraphic columns
8	Biostratigraphic correlation and contour maps: classification of index fossils and definition of faunal assemblages; subsurface structural contours and isopach maps; gamma ray log interpretation
9	Sequence and seismic stratigraphy: well correlations using chronostratigraphic vs. lithostratigraphic approaches; Walther's law; interpretation of seismic stratigraphy using forward seismic models
10	Carmacks stratigraphic section correlations and report writing