



Geology (GEOL) 610

Quaternary Dating Methods (Revision 1)

Status: Replaced with new revision, see the [course listing](#) for the current revision ❌

Delivery mode: [Individualized study online](#). Delivered via Brightspace.

Credits: 3

Area of study: Science

Prerequisite: None

Precluded: None

Faculty: [Faculty of Science and Technology](#) ↗

Notes:

To take this graduate-level course, you must apply and be approved to one of the graduate programs or as a non-program [Centre for Science](#) ↗ graduate student. Minimum admission requirements must be met. Undergraduate students who do not meet the admission requirements will not normally be permitted to take this course.

Coordinator: [Dr. Ken Munyikwa](#) ↗

Overview

The Quaternary Period spans the last 2.58 million years of Earth's history. To study the Quaternary Period effectively, it is imperative to assign a chronological scale to events that form part of the record. This course examines the range of techniques that can be used to date Quaternary events.

Methods covered include radiometric dating methods, annually banded records, relative ordering, and age equivalence dating techniques. You will learn that geochronologic methods generally have specific time ranges over which they can provide reliable ages. Furthermore, a given dating method can only be applied on specific natural materials.

The choice of a dating method selected for a particular task depends on the interval of the Quaternary that is being dated and on the materials that are available for dating. In each instance, the principles behind the method, sources of error, and applications of the method are examined.

Outline

GEOL 610 is divided into eight units:

- Unit 1: Dating Methods of the Quaternary
- Unit 2: Radiocarbon Dating
- Unit 3: Dating Using Long-Lived and Short-Lived Radioactive Isotopes
- Unit 4: Radiation Exposure Dating
- Unit 5: Dating Using Annually Banded Records
- Unit 6: Relative Dating Methods
- Unit 7: Techniques for Establishing Age Equivalence
- Unit 8: Dating the Future



Learning outcomes

Upon successful completion of this course, you should be able to

- appraise the importance of geochronologic dating in Quaternary studies.
- evaluate the principles behind radiometric dating methods used to date the Quaternary.

- investigate the principles, sources of error, and applications of radiometric dating methods, including radiocarbon, argon-isotope, uranium-series, cosmogenic nuclides, lead-210, caesium-137, and silicon-32 dating.
- review the principles, sources of error, and applications of radiation exposure dating methods, including luminescence, electron spin resonance, and fission track dating techniques.
- critique the principles, sources of error, and applications of dating methods based on annual increments, including dendrochronology, varve chronology, and annual layers in glacial ice.
- appraise the principles and applications behind relative dating methods, including rock surface weathering, pedogenesis, and amino acid geochronology.
- reflect on the principles behind methods that are used to establish age equivalence, including oxygen isotope chronostratigraphy, paleomagnetism, and paleosols.
- critique the advances that could be made to Quaternary dating methods in the near future.

Evaluation

To **receive credit**  for GEOL 610, you must achieve a grade of at least **B- (70 percent)**  on the midterm paper and final exam, as well as an average grade of at least B- (70 percent) on the four assignments.

Activity	Weight
Assignment 1	12%
Assignment 2	12%

Activity	Weight
Midterm paper	22%
Assignment 3	12%
Assignment 4	12%
Final exam	30%
Total	100%

Materials

Digital course materials

Links to the following course materials will be made available in the course:

Walker, M. (2005). *Quaternary dating methods*. John Wiley and Sons.

Important links

- › [Important Dates and Deadlines](#) 
- › [MSc ESS Contact Information](#) 

> [MSc ESS Program Regulations](#) 

Athabasca University reserves the right to amend course outlines occasionally and without notice. Courses offered by other delivery modes may vary from their individualized study counterparts.

Opened in Revision 1, July 22, 2025

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