LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN
DEPARTMENT FÜR GEO- UND UMWELTWISSENSCHAFTEN
SEKTION GEOLOGIE

Quaternary Dating Methods SoSe 2020 - Syllabus

Dr. Florian Hofmann
Visiting Professor of Earth Surface Processes

Course description

This course will introduce you to quantitative dating methods on timescales from 10 a to 1 Ma. You will develop an understanding of radioactive decay and how it can be used to measure time. We will discuss sample preparation and analytical methods, as well as the most commonly used Quaternary geochronologic techniques and their applications.

This course is listed in the Master's program in Geology, but students from other courses of study are welcome to join as well. Quaternary dating methods have common applications to all fields of science that study events over the past ~2 Ma, for example geography, anthropology, and archeology.

Learning objectives

At the end of this course, you will be able to:

- Apply the radiometric age equation
- Describe commonly used Quaternary dating techniques
- Evaluate the applicability and limitations of different dating methods
- Derive the timing, duration, and rates of processes from geochronologic data
- Choose an appropriate technique to solve a specific research problem
- Design a research project using quantitative dating methods

Course content

#	Title	Topics
1	Introduction to Dating Methods	Absolute vs. relative dating, banded records, isotopes, radioactivity
2	Age equation	Deriving the age equation, simple applications, half-life
3	Analytical Methods	Sample preparation, mass spectrometry, isotope dilution, uncertainty
4	Radiocarbon dating	Radiocarbon (^{14}C) dating, dendrochronology
5	The U-Pb system	U and Th decay chains, U-Pb dating laser ablation, isotope dilution
6	Disequilibrium methods	Deriving equations for disequilibrium, ^{230}Th, ^{234}U, carbonates
7	Diffusion and Thermochronology	Deriving the diffusion equation and special solutions
8	The (U-Th)/He system	Helium production, disequilibrium correction, diffusive loss
9	The K-Ar system	K-Ar dating, Ar-Ar dating, application to young volcanics
10	Cosmic rays	Cosmic radiation, spallation, production of nuclides
11	Stable cosmogenic nuclides	Stable TCNs: ^{3}He, ^{21}Ne
12	Radioactive cosmogenic nuclides	Radioactive TCNs: ^{10}Be, ^{26}Al, ^{14}C, ^{36}Cl; burial dating
13	Luminescence	OSL, IRSL, TL
14	Common applications	Erosion rates, catchment-averaged methods, soils, fault offset rates, glacial deposits
15	Project Presentations	

Course format

This course will be taught online, at least while COVID-19-related restrictions are in place. Lectures are being provided as videos, which are usually split into two to four parts. After each part, there will be short quiz that will help you to familiarize yourself with the contents of the lecture. The lecture videos will be made available to you on the day of the class. During the official class time, I will be available in the Moodle forum to answer questions. About one hour into the official class period, I will also be on Zoom, where we can discuss the contents of the class.

If you want to participate in this course, please send me an email at fh.sose2020@gmail.com and sign up for the course on Moodle: https://florianhofmann.moodlecloud.com. Unfortunately, due to the current circumstances, the administration has not been able to provide me with an LMU email address and login, and I don't have access to any of the LMU resources yet. Therefore, I will have to use publicly available resources (Gmail, personal Moodle, Youtube) to facilitate this lecture. I will switch the course to LMU resources (LMU email, LMU Moodle, Streaming, LMU Zoom etc.) as soon as I receive my login, which I will announce via Moodle and email.

Let me know if you have any restrictions or a lack of equipment (slow internet connection, no microphone etc.), which would prevent you from taking full advantage of the provided material and we can find a different solution.

Assessment

The assessment for this course is based on three components. You can reach a total of 500 points.

- Online quizzes accompanying lectures: 14 quizzes (15 points each), only best 10 are being counted (total of 150 points)
- Homework: 6 sets (50 points each), only best 4 are counted (total of 200 points)
- Final presentation: develop a research question, find a suitable dating technique to solve the problem, and present your approach to the class (150 points)

Taking the course for credit

If you are enrolled in the Master's program in Geology, you will get credit for this course. Students from other courses of study can take this course and receive a grade, but they need to arrange with their program coordinator ahead of time whether they can get official credit. If you are interested in this course, but don't need/want official credit for it, you have the option of auditing it. Let me know when you sign up for the course in Moodle (and send me an email) and I will make it possible for you to watch the videos and do the quizzes (without credit).

Further information and contact

http://florianhofmann.org

https://www.en.geologie.geowissenschaften.uni-muenchen.de/people/profs/hofmann_florian

fh.sose2020@gmail.com ← please use this email address for the time being

https://florianhofmann.moodlecloud.com ← preliminary Moodle