UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Geobiology

2627-1-F7402Q051

Aims

The course provides an understanding of the main interactions between the biosphere, geosphere, and hydrosphere over geological time, the geobiodiversity and its products, and the standard classification schemes for carbonate rocks and sediments of biogenic origin.

D1:Knowledge and Understanding
Students will develop an advanced understanding of the interactions and coevolution among the biosphere, hydrosphere, and geosphere, with a particular focus on marine systems. They will gain knowledge of the major events in the evolution of life and mass extinctions in Earth's history, as well as the origin and evolution of organic calcification and biomineralization processes. The course will cover the main stages in the evolution of bioconstructor communities during the Phanerozoic and the distribution of modern bioconstructions. They will also understand the role of abiotic (climatic, edaphic) and biotic factors in shaping marine biotopes and their sensitivity to past and ongoing climate change. They will acquire in-depth knowledge of photosynthesis and chemosynthesis, and their role in the evolution of life and in current food webs, as well as the relationships between ocean chemistry and biomineralization. Finally, they will study the major carbonate rocks, their primary constituents, and their classification systems.

D2: Applying knowledge and understanding
Students will be able to recognize, analyze, and describe benthic communities, assessing their spatial and temporal distribution and relating them to the evolution of marine environments. They will be able to apply actuopaleontological approaches, using modern benthic communities and their zonation as a key to interpreting paleoenvironments of the recent geological past. Furthermore, they will acquire the ability to evaluate chemical processes and their effects on biomineralization over geological time. Finally, they will be able to describe biogenic carbonate rocks and interpret their characteristics for the purpose of reconstructing the depositional paleoenvironment.

D3: Making judgements
Students will be able to identify appropriate relationships in space and time among the interactions of the geosphere, hydrosphere, and biosphere. Furthermore, they will be able to conduct robust interpretations of

carbonate rocks and sediments of biogenic origin based on the definitions, principles, and classifications studied.

D4: Communication Skills
Students will be able to articulate the interactions between the geosphere, biosphere, and hydrosphere using appropriate language and to explain the meaning of the definitions, principles, and classifications.

D5: Learning Skills
Students will be able to apply the skills and concepts they have acquired to interpret real-world phenomena, both current and historical.

Contents

Coevolution of the geosphere, hydrosphere, and biosphere.
Understanding of the major events in the evolution of life on Earth, including mass extinctions.
Understanding of biogenic carbonate rocks and their classification.
The concept of bioconstruction, sediments, and benthos.
Carbonate factories.
Biotic and abiotic factors controlling the production and distribution of biogenic carbonate sediments.
Benthic zonation.
Biomineralization.
Geosciences for the interpretation and reconstruction of the ecological history of coastal environments, climate change, and ongoing global change.

Detailed program

Lectures, delivered didactic:
Major events in Earth’s history related to the development of life and mass extinctions and cronostratigraphic chart.
The emergence of organic calcification and biomineralization processes. Photosynthesis and chemosynthesis.
Ocean chemistry and biomineralization.
The evolution of bioconstructor assemblages in the Phanerozoic.
Current bioconstruction: structures, biological associations, controlling ecological factors, and distribution.
Diagnostic characteristics, significance, and distribution of the main benthic associations and associated sediments.
Biocenoses, communities, associations, and zonation of the benthos in modern seas as a key to interpreting environments of the recent past.
Chemical phenomena at the water-sediment interface.
Carbonate rocks: components and classification systems.

Laboratory, interactive didactic:
carbonate rocks and carbonate factories, classification, components, processes, and environments of formation.
Identification of carbonate rock components in thin sections under an optical microscope.

Prerequisites

General Palaeontology, Micropaleontology, Fundamentals of carbonate rocks.

Teaching form

- 16 two-hours + 1 three-hour lectures, in person, Delivered didactics (35 hours, 5 cfu)
- 4 three-hours practical classes, in person, Interactive Teaching. Mandatory attendance for at least 2/3 of the total hours to access the exam. A brief report on the laboratory activities must be submitted before the final exam.

Textbook and teaching resource

- The lectures and some suggested readings will be provided by the teacher.
- Fundamentals of Geobiology, Knoll et al (Eds) ISBN 978-1-4051-8752-7. Some copies are available at the University library.
- Microfacies of carbonate rocks : analysis, interpretation and application, Flu?gel E. (Aut) ISBN: 354022016X, 9783540220169

Semester

First semester

Assessment method

The assessment method consists of a written exam with open questions.
The written exam consists of:

- 1 mandatory question (see below) designed to assess knowledge of the main divisions of geological time;
- 10 open questions designed to assess understanding of the concepts explained during lectures and the ability to integrate the acquired knowledge, evaluate it critically, and express oneself appropriately.
  A failing grade on the first question prevents from continuing to grade the exam and requires the student to retake the exam.

The final grade is based on the written exam score, in which each answer is assigned 0 to 3 points. A positive adjustment of 0 to 1 point is added to the written exam score as an evaluation of the laboratory activity report. If the mandatory attendance requirement of at least 2/3 of the laboratory hours is not met, students will not be allowed to take the exam.

Grades are expressed as n/30. The minimum passing grade is 18/30.

The final evaluation is on a scale of 30 and will be based on the following criteria:
D1 - Knowledge and comprehension
D2 - Ability to apply knowledge and understanding
D3 - Independent judgment
D4 - Communication skills
D5 - Learning ability

Grade < 18
D1: The student demonstrates fragmented theoretical knowledge.
D2: The student is unable to integrate knowledge into a comprehensive analysis of the case studies.
D3: The student processes information inaccurately and incompletely and does not analyze concepts critically.
D4: In the written exam, the student does not use appropriate language and communicates unclearly and ineffectively.
D5: The student does not demonstrate awareness of their own learning process and fails to make essential connections.

Grade 18–22
D1: The student demonstrates fairly comprehensive theoretical knowledge but with some inaccuracies.
D2: The student integrates this knowledge into the analysis of case studies but does so incompletely.
D3: The student is able to discuss concepts critically but at a basic level and with inaccuracies.
D4: In the written exam, the student uses appropriate language, albeit with some inaccuracies, and communicates fairly clearly.
D5: The student demonstrates a basic awareness of their own learning process and is able to make some essential connections.

Grade 23–27
D1: The student demonstrates comprehensive and in-depth theoretical knowledge.
D2: The student satisfactorily integrates this knowledge into the analysis of case studies.
D3: The student is able to discuss concepts critically and coherently, demonstrating good analysis of the information.
D4: In the written exam, the student demonstrates good command of language and communicates clearly and effectively.
D5: The student demonstrates good awareness of their own learning process and is able to highlight the connections between the various cases analyzed.

Grade 28–30
D1: The student demonstrates comprehensive, in-depth theoretical knowledge presented in a rigorous manner.
D2: The student demonstrates an advanced ability to integrate knowledge for the analysis of case studies and the interpretation of the analyzed data.
D3: The student is able to argue concepts critically and coherently, presenting information in a solid and articulate manner with a well-structured logical flow.
D4: In the written exam, the student demonstrates excellent command of language and communicates clearly and effectively.
D5: The student demonstrates an advanced awareness of their own learning process and effectively, coherently, and rigorously connects the various cases analyzed.

Exam Dates:

- February 2, 2027, 2:30 PM
- February 18, 2027, 2:30 PM
- April 1, 2027, 2:30 PM

Office hours

To make an appointment, please contact me by mail: valentina.bracchi@unimib.it

Sustainable Development Goals

QUALITY EDUCATION | CLIMATE ACTION | LIFE BELOW WATER