UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biogeosciences and Global Changes

2627-1-F7504Q041

Aims

Knowledge and understanding
Students will develop an advanced understanding of the interactions and coevolution between biosphere, hydrosphere and geosphere, with particular attention to marine systems. They will acquire knowledge of the major extinction events in Earth's history, the origin and evolution of organic calcification and biomineralisation processes, the evolution of bioconstructor associations throughout the Phanerozoic, and the distribution of present-day bioconstructions. They will understand the role of geological drivers in shaping the marine biotopes, and their sensitivity to the ongoing climate change. Students will also gain insights into photosynthesis and chemosynthesis and their role in the evolution of life and in the present-day trophic webs, and will be introduced to the relationship between ocean chemistry, biomineralisation, and biogeochemical proxies.

Applying knowledge and understanding
Students will be able to recognise, analyse, and describe bioconstructions and benthic associations, assessing their spatial and temporal distribution and linking them to the evolution of marine environments. They will identify those situations in which the lack of historical data requires the use of actualistic approaches, using modern benthic communities and their zonation and biogeochemical proxies as a key to interpreting the fossil evidence of recent past environments, for the reconstruction of long-term ecological trajectories. Furthermore, students will acquire the ability to evaluate chemical processes at the water–sediment interface and to employ biogeochemical proxies and natural archives to reconstruct past environmental changes and to assess ongoing global change and the role of the oceans within it.

Contents

The Earth as a dynamic planet. The structure of our planet and seafloors, coevolution of geosphere and biosphere, extinctions, bioconstruction and habitat engineers, hard and soft substrates, sediment classification and components, marine erosion and deposition, benthic zonation, principles of biomineralization, introductory biogeochemistry and proxy data in natural archives, geosciences for the interpretation and reconstruction of the

ecological history of coastal environments, past and ongoing global changes, strategies of CO2 removal and mitigation of climate change.

Detailed program

Lessons: Extinctions and major events in the Earth history. The appearance of organic calcification and the biomineralization. Photosynthesis and chemosynthesis. Ocean chemistry and biomineralization. The evolution of biogenic builders in the Phanerozoic. The modern bioconstruction: structures, biological associations, ecological factors of control and distribution. Habitat engineers. Diagnosis, significance and distribution of the major benthic associations and related sediments. Biocoenoses, communities, associations and benthic zonation in the present-day oceans as model for the interpretation of recent past environments. The chemical environment at the water-sediment interface. Identification and interpretation of the most important ichnofacies. Biogeochemical proxies and natural archives. The ongoing global change and the role of the oceans.

Practical classes:
Grain sizes and components of marine sediments in the context of marine benthic bionomics.
Observations under an optical microscope of the most common shell and skeletal structures.
Observations on the major marine bioconstructors throughout the planet's history.

Prerequisites

Fundamentals of Marine Biology, Ecology and Physical geography, or General Palaeontology

Teaching form

- 17 two-hours + 1 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.

Textbook and teaching resource

The lectures and some suggested readings provided by the teacher

Useful books: Fundamentals of Geobiology, Knoll et al (Eds) ISBN 978-1-4051-8752-7. Some copies are available at the University library.

Semester

First semester

Assessment method

Written test or optional oral examination. If the compulsory attendance for at least 2/3 of the laboratory hours is not respected, it will not be possible to take the oral exam.

The written exam of 25 multiple-choice questions and one open question will test the understanding of the main concepts presented during the course, the ability to integrate the knowledge from different topics and to use a proper technical language. The oral is optional, and can be taken instead of the written test. Each multiple-choice question worths 1 point for the correct answer, and the open question worths a maximum of 4 points. Therefore, the total points for a correct written test gives 29 points.

The final mark is composed of the written grade plus 1 point for the positive evaluation of the practicals report.

The final grade is expressed on a 30-point scale. In the event of a negative final assessment (i.e., lower than 18/30), or in case of rejection of a positive mark, the student will not be allowed to register for the immediately next exam session.

The assessment will be based on the following criteria:

D1 – Knowledge and understanding
D2 – Applying knowledge and understanding
D3 – Making judgements
D4 – Communication skills
D5 – Learning skills

Assessment below 18/30
D1: The student demonstrates fragmented theoretical knowledge.
D2: The student is unable to integrate knowledge into a complete analysis of case studies.
D3: The student processes information inaccurately and incompletely and is unable to critically elaborate on the concepts.
D4: During the presentation and/or oral examination, the student does not use appropriate scientific terminology and communicates in an unclear and ineffective way.
D5: The student does not demonstrate awareness of their learning process and is unable to identify the essential connections among the topics addressed.

Assessment 18–22/30
D1: The student demonstrates fairly complete theoretical knowledge, although with some inaccuracies.
D2: The student integrates knowledge into the analysis of case studies, but in an incomplete way.
D3: The student is able to discuss concepts critically at a basic level, with some inaccuracies.
D4: During the presentation and/or oral examination, the student uses appropriate scientific terminology, although with some inaccuracies, and communicates in a reasonably clear way.
D5: The student demonstrates a basic awareness of their learning process and is able to identify some essential connections among the topics addressed.

Assessment 23–27/30
D1: The student demonstrates complete and in-depth theoretical knowledge.
D2: The student satisfactorily integrates knowledge into the analysis of case studies.
D3: The student is able to critically and coherently discuss concepts, showing good ability to elaborate information.
D4: During the presentation and/or oral examination, the student demonstrates good command of scientific terminology and communicates clearly and effectively.

D5: The student demonstrates good awareness of their learning process and is able to highlight the connections among the different cases analysed.

Assessment 28–30/30
D1: The student demonstrates complete, in-depth, and rigorous theoretical knowledge.
D2: The student demonstrates an advanced ability to integrate knowledge for the analysis of case studies and the interpretation of the analysed data.
D3: The student is able to critically and coherently discuss concepts, elaborating information in a solid and articulated way, with a well-structured logical approach.
D4: During the presentation and/or oral examination, the student demonstrates excellent command of scientific terminology and communicates clearly and effectively.
D5: The student demonstrates advanced awareness of their learning process and is able to connect the different cases analysed in an effective, coherent, and rigorous way.

Office hours

To make an appointment, please contact me by mail: daniela.basso@unimib.it

Sustainable Development Goals

QUALITY EDUCATION | LIFE BELOW WATER