UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biofacies

2627-1-F7402Q053

Aims

Analysis of Cenozoic biofacies and their components., Provide the taxonomic background for the identification of the main planktonic and benthic species of marine microfossils. Provide knowledge of species useful for palaeoenvironmental and biostratigraphic interpretation of samples from different oceanographic settings. Apply microfossil assemblages for palaeoecological reconstructions.

D1 – Knowledge and understanding:
During lectures, students will learn how to describe and identify the main marine microfossils as well as the components (both biogenic and non biogenic) of the associated sedimentary deposits. They will understand their distribution in present-day and past oceans, recognise their relationship with environmental parameters, and learn their stratigraphic ranges.

D2 – Applying knowledge and understanding:
During interactive lectures and laboratory activities, students will apply the acquired knowledge to case studies by analysing the distribution and abundance of several marine microfossil taxa in order to reconstruct past environments and by using marker species for rock dating. During field activities, students will learn how to recognise biofacies as a tool for palaeoenvironmental interpretation.

D3 – Making judgements:
During interactive lectures, students will learn how to critically evaluate the approaches described in the analysed scientific papers and compare different interpretations. During laboratory activities, students will independently interpret the obtained data by comparing them with information available in the scientific literature in order to assess palaeoenvironmental conditions. Through the preparation of the laboratory report, students will improve their critical thinking skills and provide an evaluation of the evolution of marine environments. During field activities, students will be able to critically interpret outcrops for palaeoenvironmental reconstruction. Through the preparation of the fieldwork report, students will be able to summarise the most relevant information and discuss it independently.

D4 – Communication skills:

During interactive lectures, students will be able to collaborate within working groups, contributing to the discussion of the analysed scientific papers and to the exchange of ideas with other students and the lecturer, using appropriate scientific terminology. At the end of the laboratory activities, students will be able to present the results of the activities carried out in small groups and discuss them clearly and effectively. They will also be able to summarise the most significant results obtained in an individual written report. During field activities, students will discuss with each other and with the lecturer the description of outcrops, improving their ability to communicate clearly and use appropriate scientific terminology. During the oral examination, students will be able to present the topics clearly and in a structured way, using appropriate scientific terminology.

D5 – Learning skills:
Students will develop their learning skills throughout all phases of the course and will be able to independently expand their knowledge through research and critical reading of scientific papers related to the topics covered.
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Contents

Biofacies and microfacies: analysis of planktic and benthic microfossils from different oceanographic contexts and their application to understanding the recent past and for rock dating

Detailed program

Lectures
Plankton module: Microfossils and oceanic palaeoenvironments. Taxonomic background for the identification of the main planktonic groups. Plankton palaeoecology and biogeography: synthesis of their environmental and palaeoenvironmental significance and critical reading of selected scientific papers.
Biofacies in pelagic environments: sedimentary environments and diagenesis. Fundamentals of biostratigraphic interpretation of sedimentary successions in pelagic environments. Examples from present-day environments and the geological record.
Benthos module: Microfossils and palaeoenvironments. Taxonomic background for the identification of the main groups of benthic foraminifera. Biogeography and distribution of benthic foraminifera in the present and in the past. Case studies through the critical reading of selected scientific papers.
Benthic foraminifera as a tool for the reconstruction of past environments. Fundamentals of biostratigraphy based on large benthic foraminifera.

Practical activities
Plankton module: Description and identification, using a polarising light microscope, of key species belonging to the main groups of present-day phytoplankton microfossils (calcareous nannofossils, diatoms, and silicoflagellates).
Recognition of microfacies and identification of palaeoenvironmental conditions in different oceanographic settings (mid-ocean oligotrophic gyres, upwelling zones, areas influenced by continental inputs, polar regions).
Identification of biozones through the recognition of planktonic biostratigraphic marker species for selected time intervals, and exercises based on published data for the construction of an age model.
Benthos module: Description and identification, using a reflected-light microscope, of the main genera of benthic foraminifera. Recognition of benthic microfacies and examples of biostratigraphic reconstructions.

Field activities
Two-day field excursion aimed at observing and analysing different biofacies through space and time.

Prerequisites

Paleontology and Geobiology are recommended

Teaching form

All classes will be in English

- 14 two-hour lectures, in person (1 CFU), of which: 8 two-hours lectures performed as Delivered didactics (16 hours); 6 two-hour classes through Interactive Teaching (12 hours)
- 6 two-hours practical classes, in person, Interactive Teaching (12 hours, 1 cfu).
- 1 two-days field activity through Interactive Teaching (1 CFU, 12 hours)

Textbook and teaching resource

Slides and scientific papers provided by the Lecturers on the e-learning page

Semester

Second semester

Assessment method

The assessment of students' achievement will be **based on**:

- Two written reports (Plankton module and Benthos module) on the laboratory activities. The reports must include a summary of the laboratory notes, observations, and exercises carried out during the activities, as well as an interpretation of the obtained results. The assessment will focus on: the completeness of the report with respect to the proposed activities, the ability to summarise and discuss the analysed data, and the ability to use appropriate scientific terminology.
- One written report (integrated activity) on the field-worl: The report must contain the information on the observed biofacies and the related paleoenvironmental interpretations.
- Group presentation. The results of the data collected during laboratory activities will be presented by students working in groups.
  The assessment will focus on: the understanding of micropalaeontological methods, the students' ability to work in a team, the use of appropriate scientific terminology, and communication skills.
- Oral examination. Two open questions on the topics covered in the two modules.
  The assessment will focus on: the knowledge acquired and the students' ability to use appropriate scientific language and demonstrate mastery of the course topics.

The three written reports will contribute overall to 1/3 of the final grade, while the oral examination will contribute to 2/3 of the final grade. The group project will be assessed during the oral presentation scheduled for the last lecture and will contribute up to 3 points to the final grade.

The final grade is expressed on a 30-point scale and 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 components 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 components analysed in an effective, coherent, and rigorous way.

Office hours

Upon appointment by e-mail to the professors

Sustainable Development Goals

QUALITY EDUCATION | LIFE BELOW WATER