Universitat Autònoma de Barcelona

2018/2019

Methods and Techniques in Paleobiology

Code: 43858
ECTS Credits: 9

Degree	Type	Year	Semester
4316238 Paleobiology and Fossil Record	OB	0	1

Contact

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Use of languages

Principal working language: english (eng)

Teachers

Oriol Oms Llobet
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Daniel de Miguel
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External teachers

Tomàs Marquès Bonet

Prerequisites

There are no pre-requirements.

Objectives and Contextualisation

The aim of this module is to provide the students the knowledge necessary to carry out their own research, according to the leading techniques, methods and software in Palaeontology.

Some other classic methods and techniques in taxonomy, sedimentology and taphonomy are further developed to provide the students advanced skills on them.

Skills

- Analyze data using adequate mathematical tools.
- Apply evolutionary concepts to resolve geological problems related to the time-ordering of fossils and the sediments that contain them.
- Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
- Continue the learning process, to a large extent autonomously.
- Defend the results, respecting and discussing those of others in English.
- Gather and synthesize information from scientific literature (library, data bases, online journals, contrasted web pages).
- Identify fossilization processes and avoid taphonomic biases in the study of the biology of organisms from the past.
- Obtain original data by means of field or lab work and process them adequately to resolve questions of a paleobiological profile.
- Recognize and use the fossil record applying the theories, paradigms and concepts of evolution and ecology to resolve specific problems of life in the past.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use a scientific argument in English to justify research results .
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use paleontological, geological, biological, chemical or physical sources of information to delimit ecological parameters in the past.

Learning outcomes

1. Analyze data using adequate mathematical tools.
2. Apply the international code of zoological nomenclature in taxonomical work.
3. Carry out a paleoenvironmental interpretation and argue and defend it.
4. Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
5. Continue the learning process, to a large extent autonomously.
6. Control field data collection methods for the study of different groups of fossils.
7. Control new non-invasive visualisation and analysis technologies for vertebrate fossil remains.
8. Defend their own results, respecting and discussing the results of others.
9. Distinguish and interpret stratigraphic sequences.
10. Gather and synthesize information from scientific literature (library, data bases, online journals, contrasted web pages).
11. Identify different techniques for the paleohistological study of vertebrate fossil elements.
12. Integrate taphonomic information in the context of biostratigraphy.
13. Integrate the taphonomic information in the context of paleoecological and paleoenvironmental interpretation.
14. Know and control study techniques for macrofossils and microfossils.
15. Know and control the different study, conservation and dissemination techniques of the vertebrate fossil register.
16. Know the formal aspects in the description of new species.
17. Recognise in the field and interpret the lateral and vertical changes in sedimentary rocks and their fossil content.
18. Recognise the eustatic variations by changes in biofacies.
19. Recognise the evolutionary interaction between organisms and environments in the stratigraphic register.
20. Relate concepts in the field of biostratigraphy and disseminate the results.
21. Relate concepts in the field of taphonomy.
22. Relate the fossil content of an outcrop with its age and environmental parameters..
23. Relate the morphofunctional characteristics of organisms with the environmental parameters in the fossil register.
24. Select data and techniques for a biomechanical study of organisms from the past.
25. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
26. Understand and use univariate and multivariate statistical methods applicable to the study of fossils.

27. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
28. Use scientific argumentation to justify the results of research.

Content

Methods and techniques in descriptive palaeontology: taxonomic procedures; description of species and formal nomenclature; description of intraspecific variation; systematics and phylogeny.

Methods and techniques in paleobiology: nature of the paleobiological data and main biases in the fossil record; basic statistical concepts and graphic representation of data; univariate and multivariate statistical methods applied to paleobiology; size and shape, allometry; paleohistology and vital history; phylogenetic analysis; geometric morphometrics (2D and 3D analysis, phylogenetic contrast); advanced methods in functional and biomechanical morphology (construction of virtual models and finite element analysis); methods in paleoecology and paleobiogeography (multivariate classification and ordering methods, ecological interactions over time); paleodiethetic reconstruction (analysis of tooth wear and stable isotopes); large databases and analysis of diversity in the fossil record.

Methods and sedimentological techniques of paleoenvironmental reconstruction: superficial formations vs non-superficial formations, inverted stratigraphic series; relationship between the type of sediment and its fossil content; abiotic processes and sedimentary structures in paleoenvironmental determination and reservoir formation; identification of secondary structures, sedimentary environments and their fossil content as environmental indicators (salinity, bathymetry); analytical techniques in paleoenvironmental determinations; sedimentological criteria in fossil prospection.

Methods and taphonomic techniques of paleoenvironmental reconstruction: theoretical-practical bases on the application of taphonomic and actuotaphonomic analysis methods in the establishment of paleoecological hypotheses. It will focus on a practical case.

Methodology

Lectures and Seminars

Practical classes

Learning based in problems

Written Works

Reading of Scientific Papers and Books

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Field Work	22.5	0.9	
Lectures and Seminars	20	0.8	2, 3, 5, 6, 7, 9, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 24
Practical classes	30	1.2	1, 2, 3, 6, 8, 9, 10, 12, 13, 16, 17, 21, 22, 25, 26, 27, 28
Type: Supervised			
Learning based in problems	4	0.16	1, 2, 5, 9, 10, 12, 16, 17, 22, 23, 25, 26, 27
Reading of Scientific Papers and Books	20.5	0.82	5, 8, 10, 28

Type: Autonomous			
Cooperative learning	4	0.16	4, 5, 8, 28
Written Work	108	4.32	1, 4, 5, 8, 10, 25, 27, 28

Evaluation

Attending and Participation in Classes

Exams

Written Works

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Attending and Participation in Classes	10%	0	0	4, 8, 21, 27, 28
Exams	50%	8	0.32	1, 3, 12, 13, 15, 16, 17, 19, 20, 21, 22, 23, 25, 26
Written Works	40%	8	0.32	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28

Bibliography

Specific references will be provided by the professor of each class.