VNIVERSITAT DE VALÈNCIA

Course Guide
46740 Laboratory techniques and analytical methods in palaeontology

COURSE DATA

DATA SUBJECT

Code: 46740
Name: Laboratory techniques and analytical methods in palaeontology
Cycle: Master's Degree
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2266 - Master's Degree in Applied Palaeontology	Facultat de Ciències Biològiques	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2266 - Master's Degree in Applied Palaeontology	Study techniques in palaeontology	COMPULSORY

COORDINATION

ABELLA PEREZ JUAN

FERRON JIMENEZ HUMBERTO GRACIAN

MARTINEZ PEREZ CARLOS

SUMMARY

The subject Laboratory Techniques and Analytical Methods is essentially a subject practice made up of laboratory activities, which will be supported by introductory / explanatory theoretical classes. The subject presents the sequence of practical work in paleontology as well as the quantity and quality of the methods and techniques used. The course will focus on the main techniques and laboratory methods most common in paleontology, including preparation (until the materials are ready for study or exhibition), the different methods of analysis and the interpretation and integration of data. The subject includes specific contents on different techniques for the extraction of macro and microfossils: mechanical and chemical methods, washing and picking of micropaleontological samples, concentration reduction techniques, making thin sheets and replicas, complemented with microscopic techniques (optical microscope and microscope), scanning electron, X-ray diffraction, isotopic analysis methods. Tomographic analysis methods in paleontology (CT and micro-CT scan, syncroton), analysis and treatment of derived data. Finally, various analytical methods will be introduced in paleontology: geometric morphometry, Finite Element Analysis. Statistical analysis of data in Paleontology.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

There are no enrolment restrictions with other subjects.

COMPETENCES / LEARNING OUTCOMES

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Access information tools from other areas of knowledge and use them appropriately.

Apply critical reasoning and argumentation based on rational criteria.

Apply the knowledge acquired and problem-solving abilities in new or unfamiliar situations within broader (or multidisciplinary) contexts related to the field of study.

Apply the research experience acquired to initiate the research phase of a PhD programme on biodiversity-related topics.

Apply the research experience acquired to tasks specific to the profession, both in the private sector and in public institutions.

Assess the need to complement their scientific, historical, language, IT, literature, social and human ethics education by attending lectures or courses and/or carrying out complementary activities, self-evaluating the contribution that these activities make to their overall education.

Assume an ethical commitment and sensitivity towards environmental problems and natural and cultural heritage.

Be familiar with, develop and manage georeferenced databases of elements from the geological and palaeontological record, as well as the software used for the spatial representation and analysis of these elements.

Collect, represent and analyse data for the interpretation and production of geological maps and/or other forms of representation (stratigraphic columns, geological cross-sections, etc.) with a view to their inclusion in reports, scientific publications or other outputs.

Communicate and popularise scientific ideas.

Communicate conclusions and the knowledge and rationale supporting them to specialised and non-specialised audiences clearly and unambiguously.

Conduct studies, applying the methods and techniques needed to preserve and manage palaeontological heritage.

Continue the learning process in a manner that is largely self-directed or independent.

Demonstrate intellectual curiosity and encourage responsibility for one's own learning.

Develop experimental skills in the handling of laboratory material and equipment in palaeontology.

Have an in-depth knowledge and understanding of the nature of biodiversity and its ecosystemic relationships both now and in the past.

Have an in-depth knowledge and understanding of the regional geology of Spain and surrounding areas, particularly the Valencian Community, with detailed knowledge of the main palaeontological sites found in the Iberian Peninsula and North Africa.

Integrate knowledge and confront the complexity of making judgements based on information that, although incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of knowledge and judgements.

Interpret environmental and ecological variables of the past from the study of organism traces in the fossil record.

Know, understand and draw conclusions, applicable to the present time, about the crises of biological diversity, and their causes and consequences within the framework of actualism.

Know and confidently handle the divisions of the geological time scale and the biostratigraphic scales constructed from different groups of biota in the fossil record.

Know and understand past biological events, as well as the zonations, in time and space, of biota in order to establish the relative stratigraphic position of sedimentary rocks from different geographical areas.

Make quick and effective decisions in complex situations in their professional or research work, by developing new and innovative work methodologies adapted to the scientific/research, technological or professional field in which they carry out their activity.

Plan and manage available resources, taking into account the basic principles of quality, risk prevention, safety and sustainability.

Prepare, write and present reports and projects in public in a clear and coherent manner, defend them with rigour and tolerance and respond satisfactorily to any criticism that may arise from the presentation.

Produce all types of reports related to palaeontological matters clearly and concisely at an official or professional level (reports, grants, heritage impact reports, research projects, etc.)

Skillfully handle the field, laboratory and office techniques for the extraction, preparation, cataloguing, digital reconstruction, study and dissemination of microfossils and macrofossils.

Understand the fundamental principles of facies analysis in continental, transitional and marine depositional systems, and the use of fossils for palaeoenvironmental interpretation of the stratigraphic record.

Understand the nature of the fossil record in relation to the sedimentary process, the biostratinomic and phosildiagenetic phases of the process and the mechanisms of fossilisation.

Understand the nature of the stratigraphic record, its discontinuities, cycles and events, the different types

of sedimentary basins, the factors controlling their infilling, the resulting three-dimensional geometries and stratigraphic correlations.

Use acquired knowledge as a basis for originality in the development or application of ideas, often in a research context.

Work efficiently in a professional or research team, acquiring the ability to participate in research projects and scientific or technological collaborations.

DESCRIPTION OF CONTENTS

1. Laboratory Techniques

Chapter 1. Macro and microfossil extraction techniques:
-Mechanical methods and chemical methods
-Washing and triage of micropaleontological samples
-Concentrate reduction techniques
Chapter 2. Preparation of paleontological samples
- Thin sections
- Levigates
- Smear
- Oriented serial sections
- Obtaining acetate peels in specimens and in mesoscopic samples
- Polished sections and basic mechanical extraction with hammer and ultrasound.
Chapter 3. Introduction to casts and molds

2. Microscopic and analytical techniques

Chapter 4. Microscopic and analytical techniques
- Optical microscope and scanning electron microscope
- Use of lucid camera and scans
- Specific photographic techniques (Mg oxide bleaching; image processing

Chapter 5. Analytical Techniques
- X-ray diffraction
- Isotopic analysis methods.

Unit 6. Computerized tomography
-Tomographic analysis methods in paleontology (CT and micro-CT scan, synchroton) T

Chapter 7. Analysis and treatment of derived data:
-Segmentation
-Obtaining virtual thin sheets

3. Computerized Techniques and Analytical Methods

Unit 6. Computerized tomography
-Tomographic analysis methods in paleontology (CT and micro-CT scan, synchroton) T

Chapter 7. Analysis and treatment of derived data: -3D models and 3D printing.

Chapter 8. Analytical methods in paleontology
-Geometric morphometry
-Finite Element Analysis / Computational Fluid Dynamics.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	15,00
Laboratory	30,00
Total hours	**45,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	0,00
Preparation of lessons	0,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**0,00**

TEACHING METHODOLOGY

Theoretical-practical classes:

- Lectures with computer presentations
- Face-to-face personal work on practical cases
- Writing reports with the teacher's guidance on practical cases
- Exhibition and public defense of the work done individually and in groups

Practical laboratory and computer classes:

- Introduction and planning of each practice
- Making observations, taking data, gathering information
- Use of specific software for data analysis
- Analysis of paleontological data

Evaluable individualized work:

- Laboratory work.
- Processing and treatment of the data obtained through the preparation of short reports.
- Elaboration of various materials and documents in theoretical-practical activities.
- Elaboration of reports on exposed contents.
- Participation in discussion groups on content related to the subject.

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EVALUATION

• Practical and / or written exercises to be carried out, individually or in groups, throughout the semester for the continuous evaluation of the technical competences of the subject

• Attendance and use of classes

• Report of laboratory-cabinet practices

• Development of a final practical work that includes the entire subject and whose contribution to the final grade may not exceed 50% of the total Evaluation activities

Evaluation Activities

• Practical work 50%

• Laboratory-cabinet practices 15%

• Memories-Reports seminars 10%

• Continuous evaluation 25%

REFERENCES

- Leiggi,P. & May , P. (Editors), 1995. Vertebrate Paleontological Techniques (Vol 1) 366 pp. Cambridge University Press - Bernhard, K. 1965 Handbook of paleontological techniques. 852pp. Freeman - Green O.R. 2001 A Manual of Practical Laboratory and Field Techniques in Palaeobiology. 538 pp. Springer Netherlands - Hammer, A. & Harper, D. A.T. 2005.

Paleontological Data Analysis. 368 pp. Wiley-Blackwell - Sutton, M.; Rahman, I. & Garwood, R. 2014. Techniques for Virtual Palaeontology. 208 pp. Wiley-Blackwell