

# SYLLABUS

University of Lille  
SECOND SEMESTER  
PANGEA TRACK/PROFILE: APPLIED PALAEOLOGY

## TITLE OF UNIT: **Advanced micropaleontology**

**NUMBER of ECTS: 3**

OPTIONAL or COMPULSORY (if applicable): **compulsory**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): **Introductory Micropalaeontology**

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **lectures, tutorials, practicals.**

Number of hours dedicated to lectures, practicals, field-excursions, etc:

**Lectures: 2 h**

**Practicals: 8 h**

**Tutorials: 8 h**

Personal workload (hours expected to be dedicated to, including supervised projects): **40 hours**

### **Description of the course:**

#### **General aims**

The objective of the course consists in learning to identify a number of microfossil groups useful in Geosciences. Morphological/anatomical and taxonomic aspects are observed and highlighted based on lengthy observations and drawings of our teaching collections;

This rather practical way of studying will help students to understand and familiarize themselves with the most important and discriminatory morphological characters proper to each fossil group. It will also familiarize them in making use of the available taxonomic catalogues and identification keys, used routinely by specialists in the field.

#### **Expected outcomes (knowledge & skills)**

Micropaleontology can make significant contributions in a wide range of scientific problems in Geosciences, Environmental and Evolutionary sciences. The potential of application of microfossils lies with their identification at species/genus level. The student will acquire some basic skills that will help him/her recognize major microfossil groups based on his/her own identifications.

#### **Content summary**

The fossil groups presented are those that are most important for biostratigraphy and palaeoenvironmental reconstructions, such as benthic and planktonic foraminifera, calcareous

nannofossils, ostracods, spores and pollen, dinoflagellates, acritarchs, chitinozoans, radiolarians, diatoms and conodonts.

**Person in charge of the unit (first and last name, e-mail)**

Taniel Danelian  
Taniel.Danelian@univ-lille.fr

<b>EVALUATION MODE (final exam, oral defense, report,...)</b>	<b>Ratio of the final grade</b>
<b>Final exam</b>	<b>50%</b>
<b>Ongoing assessment</b>	<b>50%</b>

**NUMBER of ECTS : 3**

**OPTIONAL or COMPULSORY (if applicable): Optional**

**PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): /.**

**MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): lectures, tutorials, practicals.**

Number of hours dedicated to lectures, practicals, field-excursions, etc:

Practicals (field excursion): **24 hours**

Personal workload (hours expected to be dedicated to, including supervised projects): **60 hours**

### Description of the course

#### General aims

About 75% of exposed rocks are sedimentary. They preserve the record of Earth's surface conditions (geosphere) and life (biosphere). Study of sedimentary rocks is thus relevant and convey implications for both academic and applied pursuits. Fieldwork is the first step of most geological and paleontological analyses, and involves making careful observations and measurements in the field, which can be really challenging even for experienced professionals. This module, based on fieldwork training, allows students to develop their skills in field-data collection, analysis, and integration into a general synthesis of a basin's history. It focuses on Paleozoic carbonate rocks and fossiliferous successions from the Ardennes Massif (France-Belgium).

Expected outcomes (knowledge)

#### Expected outcomes (skills)

- Field workflow
- Field data collection (sampling strategy; outcrop sketching; detailed logging of sedimentary sequences; getting information from fossils in the field, etc.).
- Stratigraphic correlation of outcrops at a regional scale.
- Macro and microfacies analyses.
- Data synthesis (stratigraphy, taphonomy, sedimentology, structural geology) and analysis at regional scale (paleoenvironments, palaeogeography).

#### Content summary

After a brief overview of the structural context and the different Paleozoic formations of the Southern Ardennes Massif, a detailed study of different key outcrops of mid-Palaeozoic successions will be conducted by groups of students. Fieldwork will be completed through carbonate microfacies analysis. Assessment of student work is based on an illustrated field and lab report including a data synthesis and interpretation of paleoenvironments, paleogeography, structures, events, etc., from outcrops to regional scale.

**Person in charge of the unit (first and last name, e-mail)**

Catherine CRONIER  
Catherine.crônier@univ-lille.fr

EVALUATION MODE (final exam, oral defense, report...)	Ratio of the final grade
Report	100 %

## TITLE OF UNIT: Supervised Project

NUMBER of ECTS : 3

OPTIONAL or COMPULSORY (if applicable): **Optional (depending on the chosen track)**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): **Knowledge in geological mapping, stratigraphy, paleontology**

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **Supervised project**

Number of hours dedicated to lectures, practicals, field-excursions, etc: N/A

Personal workload (hours expected to be dedicated to, including supervised projects): **60 hours**

### Description of the course

#### General aims

This course has been introduced for students who, for any reasons, would not be able to join field-trip course. It is aimed at developing a paleontological project based on a field-trip.

#### Expected outcomes (skills)

The students will be able to set a basic research project based on a field-trip. They will learn how to prepare, plane, organize a field trip. They should be able to find local regulation on geological material and how to get permission of exportation if necessary.

#### Content summary

Student will introduce a written research project for which a field-trip is essential. Their report will include a presentation of the state of the art, their research goals and related methodology. An significant part of the report will be dedicated to the presentation of the geological setting of the proposed study, followed by an argued selection of outcrops to be sampled in order to reach defined research objectives, field planning and budget. Accessibility, legal restrictions and eventual way of getting permission for sampling and export material, along with possible local collaborators, will also be evaluated.

**Person in charge of the unit (first and last name, e-mail)**

Sebastien CLAUSEN  
sebastien.clausen@univ-lille.fr

EVALUATION MODE (final exam, oral defense, report,...)	Ratio of the final grade
Written Report	100%

**TITLE OF UNIT: Internship****NUMBER of ECTS: 3**OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): /.

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **supervised project**Number of hours dedicated to lectures, practicals, field-excursions, etc: **2 month-internship.**Personal workload (hours expected to be dedicated to, including supervised projects): **> 60 hours****Description of the course****General aims**

Placing the skills acquired during the year into practice by engagement in a professional environment such as a company, a consulting service, a private or public research laboratory, a local authority, etc.

**Expected outcomes (skills)**

Some of the expertise gathered by the end of the module include: (1) Write a cover letter in order to obtain an internship (help from Lille PassPro office); (2) Professional experience by immersion during several months in a company or research laboratory; (3) Follow a scientific approach (middle term project) to a given subject by interpreting and analyzing data as well as highlighting the results; (4) following the rules of scientific writing, producing a quality written document and present orally its results.

**Content summary**

The content depends on the ambitions and the professional project of each student. The search for an internship must be voluntary and active and started by the student. This search is comparable to a job search and it is therefore considered as an integral part of the training. We are counting on a proactive student behavior, however, we will help the student if needed by taking advantage of the links that we have with several partner companies.

The subject of the internship must be discussed with the supervisor. It must also be endorsed by the module manager to ensure that the internship fits well with the objectives of the master.

The evaluation will be done according to three aspects: first, an appreciation of the supervisor; second, a note concerning the written report given by the module manager and a specialized reviewer and third, an oral note given by a permanent jury.

**Person in charge of the unit (first and last name, e-mail)**

Cesar Witt  
cesar.witt@univ-lille.fr

<b>EVALUATION MODE (final exam, oral defense, report,...)</b>	<b>Ratio of the final grade</b>
<b>Report</b>	<b>40%</b>
<b>Oral communication</b>	<b>40%</b>
<b>Assessment by supervisor</b>	<b>20%</b>

## TITLE OF UNIT: Literature review

NUMBER of ECTS: 3

OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): /.

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **lectures and supervised project**

Number of hours dedicated to lectures, practicals, field-excursions, etc: **4 hours**

Personal workload (hours expected to be dedicated to, including supervised projects): **60 hours**

### Description of the course

#### General aims

This module attempts to develop the student's capacities for building a report based entirely on bibliographic research. The exercise attempts: (1) to improve the student's bibliographic research skills by using open resources (Haal, Research Gate, etc.) or those to which access is provided by the University (Science Direct, Lyel Collection ...) and (2) to improve their technical or scientific writing skills by developing a memory related to their future research project. Finally, the module will allow the student to learn the use of bibliographic referencing softwares such as Zotero or EndNote.

#### Expected outcomes (knowledge/skill)

At the end of the module, the student will be able to: (1) properly identify scientific and technical sources for obtaining bibliographic material and building a list of references; (2) be familiar with technical and scientific writing including ethic elements; (3) use bibliographic software and (4) improve their ability to divulge results in front of a jury.

#### Content summary

The student will chose a topic and will be guided by the supervisor and the module manager to build a report with well-developed and clearly differentiated sections. The student will be guided to respect bibliographic rules including non-plagiarism.

The choice of the subject will be based, preferably, on adaptation to the student's future internship project and in this way will benefit from a second reading (apart from that of the module manager) from the future internship supervisor.

The evaluation will be made according to three four:

1. the quality of the list of bibliographic resources;
2. the quality of writing including the correct separation between the problematic, the development of ideas and the results;

3. the general presentation of the manuscript and;
4. an oral note given by a permanent jury.

**Person in charge of the unit (first and last name, e-mail)**

Cesar Witt  
cesar.witt@univ-lille.fr

<b>EVALUATION MODE (final exam, oral defense, report,...)</b>	<b>Ratio of the final grade</b>
<b>Report</b>	<b>70%</b>
<b>Oral defense)</b>	<b>30%</b>

**TITLE OF UNIT:** Language

**NUMBER of ECTS :** 3

**OPTIONAL or COMPULSORY (if applicable):** Compulsory

**PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course):** /.

**MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc):** distance education, lectures, tutorials, practicals.

Number of hours dedicated to lectures, practicals, field-excursions, etc:

**Lectures:** 8 h

**Practicals:** 16 h

Personal workload (hours expected to be dedicated to, including supervised projects): **60 hours**

### Description of the course

**General aims**

**Expected outcomes (knowledge)**

**Expected outcomes (skills)**

**Content summary**

**Person in charge of the unit (first and last name, e-mail)**

Sebastien CLAUSEN

sebastien.clausen@univ-lille.fr

EVALUATION MODE (final exam, oral defense, report,...)	Ratio of the final grade
Final exam	1/4
Ongoing assessment (case studies)	1/4
Supervised project (and oral defense)	1/2

## TITLE OF UNIT: **Multivariate statistics**

**NUMBER of ECTS: 3**

OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): /.

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **lectures, tutorials, practicals.**

Number of hours dedicated to lectures, practicals, field-excursions, etc:

Lectures:

Practicals:

Personal workload (hours expected to be dedicated to, including supervised projects): **60 hours**

### Description of the course

#### General aims

Expected outcomes (knowledge)

Expected outcomes (skills)

#### Content summary

Person in charge of the unit (first and last name, e-mail)

EVALUATION MODE (final exam, oral defense, report...)	Ratio of the final grade
Final exam	1/4
Ongoing assessment (case studies)	1/4
Supervised project (and oral defense)	1/2

**TITLE OF UNIT: Vertebrate Paleontology & Palaeobotany****NUMBER of ECTS: 3**OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): /.

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **lectures, tutorials, practicals.**

Number of hours dedicated to lectures, practicals, field-excursions, etc:

**Lectures: 4h****Practicals: 4h****Tutorials: 4h**Personal workload (hours expected to be dedicated to, including supervised projects): **30 hours****Description of the course****General aims**

Recognition, at different scales, of adaptations in flora &amp; vertebrate fauna for palaeo-continental environment from Paleozoic to Paleolithic.

**Content summary**

Some assemblages of different palaeoecosystems will be presented to illustrate fossil diversity, tetrapod emergence to understand extrinsic selection pressures. The course will highlight anatomical adaptations and geological &amp; paleoenvironmental context of terrestrialization (vertebrates &amp; botanic palaeozoic indexes), mammals diversity, ocean markers &amp; origin of teeth.

**Person in charge of the unit (first and last name, e-mail)**

Claire Derycke

[Claire.Derycke@univ-lille.fr](mailto:Claire.Derycke@univ-lille.fr)

EVALUATION MODE (final exam, oral defense, report,...)	Ratio of the final grade
Final exam	50 %
Ongoing assessment	50%

## TITLE OF UNIT: Palaeoenvironmental reconstructions 1

NUMBER of ECTS : 3

OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): /

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **lectures, tutorials, practicals.**

Number of hours dedicated to lectures, practicals, field-excursions, etc:

**Lectures: 6h**

**Practicals: 6h**

**Tutorials: 6h**

Personal workload (hours expected to be dedicated to, including supervised projects): **40 hours**

### Description of the module

#### General aims

The objective of the module consists in learning how to use the taxonomic information of fossils for paleoceanographic and paleoclimatic reconstructions, as well as proxies of possible anthropogenic pollution. The student will learn how fossil assemblages of **planktonic** microfossils are used for the reconstruction of past temperature or salinity or primary productivity of surface waters, or as tracers of intermediate water masses. He/she will also learn how specific groups of **benthic** fossils may be used as proxies for the reconstruction of anoxic/dysoxic/well oxygenated conditions on the seafloor, or for following the emplacement and development of the psychrosphere (fauna proliferating in cold deep water masses). Finally, he/she learn the contribution that **terrestrial palynology** can make in reconstructing past vegetal ecosystems highly dependent on the climate state.

#### Expected outcomes (knowledge and skills)

Micropalaeontology can make significant contributions in Palaeoceanography and Palaeoclimatology, by using morphological/anatomic and assemblage based information available in abundance on microfossils. The student will acquire and develop skills in using planktonic microfossils (planktonic foraminifera, radiolaria, diatoms, calcareous nannofossils, dinoflagellates, acritarchs) and benthic morphogroups (foraminifera, ostracods) for palaeoclimatic and palaeoceanographic reconstructions, as well as the use of terrestrial palynology (spores and pollen) in reconstructing vegetal palaeoecosystems, climatic parameters relevant to temperature and humidity and climate change based on palynological spectra analysis.

## Content summary

The module will start with a brief introduction of modern oceanographic settings influencing changes in temperature, salinity and productivity of surface water masses, the level of oxygenation on the sea floor, as well as the global conditions favoring the development of cold deep water circulation. It will be followed by the presentation of methods using planktonic microfossils for palaeoclimatic reconstructions (transfer functions based on microfossil assemblages, plankton palaeobiogeography dynamics), the use of microfossil evidence for changes in salinity, as well as the use of benthic microfossil morpho-ecological groups as proxies of sea-floor palaeoenvironments. Finally, the methods and techniques of studying spores and pollen for palaeoclimatic studies will be presented.

## Person in charge of the unit (first and last name, e-mail)

Taniel DANELIAN  
[taniel.danelian@univ-lille.fr](mailto:taniel.danelian@univ-lille.fr)

EVALUATION MODE (final exam, oral defense, report,...)	Ratio of the final grade
Ongoing assessment	30 %
Final exam	70 %

**TITLE OF UNIT: Organic Matter****NUMBER of ECTS: 3**OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (either in term of skills or knowledge or units to be validated before registration to this course): /.

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **lectures, tutorials, practicals.**

Number of hours dedicated to lectures, practicals, field-excursions, etc:

Lectures

Practicals:

Personal workload (hours expected to be dedicated to, including supervised projects): **60 hours****Description of the course****General aims**

This unit is aimed at developing skills in the interpretation of data associated to organic matter in sedimentary rocks and use this information in different contexts.

**Expected outcomes (skills)**

- Understanding the many environmental/geological processes involved in the formation of organic-rich source rocks and their evolution upon burial.
- Knowing the most common techniques used to characterise sedimentary organic matter and being able to interpret the obtained results in terms of origin and thermal maturity.

**Content summary**

From primary productivity to burial of organic matter. Formation of fossil fuels.  
Characterisation of organic matter : elemental analysis, Rock-Eval pyrolysis, microscopic observation, molecular characterisation and biomarkers.

**Person in charge of the unit (first and last name, e-mail)**

Armelle RIBOULLEAU  
armelle.riboulleau@univ-lille.fr

<b>EVALUATION MODE (final exam, oral defense, report,...)</b>	<b>Ratio of the final grade</b>
<b>Final exam</b>	<b>1/4</b>
<b>Ongoing assessment (case studies)</b>	<b>1/4</b>
<b>Supervised project (and oral defense)</b>	<b>1/2</b>