Domain: Earth and Universe Sciences

Field: Geology

Specialty: Applied Geology

UNDERGRADUATE EDUCATION OFFER

Academic

LMD

Applied Geology

SEMESTER 1

Semester 1:

Unit 2: MEU11

Heading of subject : Biology 1

Lectures: 1h 30 Lab practises: 1h 30

Coeff. 2 Credit. 4

Objectives of the course

To know the main groups of living organisms in terms of general architecture, characteristics and systematics and evolution. Particular importance will be given to the updating of the classification and to the zoological groups.

Content of the subject :

PART I. SYSTEMATICS

Chapter 1: Presentation of the animal world

-Basics of classification

-Zoological nomenclature

-Evolution and phylogeny

-Numerical importance of the Animal Kingdom

Chapter 2: General information on the sub-division Protozoa

Chapter 3: Subdomain Metazoa

-Phylum Spongaria

-Phylum Cnidaria

-Phylum Annelida

-Phylum Mollusca

-Phylum Arthropoda

-Phylum Echinoderms

-Phylum Chordates

Chapter 4: Class of Vertebrates Generalities and General Systematics

Practical work :

Study of some typical species of Protozoa

Trypanosomarhodesiense, Leishmania major, Leishmania infantum,

Trypanosomagambiense, Entamoebahistolytica, Parameciumspp

Study of some typical species of Arthropods: Crustaceans (King Prawn, Squilla, morphology and biramed appendages), Chelicerata (Scorpion), Insects (Cricket, Bee).

Study of some typical species of Echinoderms: Echinids (Sea Urchin), Asteroids (Sea Star).

Assessment method

Semester 1:
Unit: MEU11

Heading of the subject : Geomorphology

Lectures: 1h 30 Lab practices: 1h 30

Coeff. 2 Credit. 4

Objectives of the course

Geomorphology is the study of landforms and the processes that shape them, usually by erosion, transport and deposition. This introductory course in geomorphology examines landforms at different spatial scales. The processes, which shape and modify the environment.

Course content :

1- Basic definitions: Topography, landforms, geomorphology, orders of magnitude of crustal relief...

2- Brief history of geomorphology: catastrophism (Georges Cuvier), uniformitarianism, evolutionists, Davis' model, W. Penck's model, Eduard Brückner's model and Albrecht Penck's model ....

3- Tectonic forms (Plate tectonics, types of plate movement, plate convergence), Orogenesis, Deformation (folds, faults, fractures and joints), Jointing, Domes and basins, Horst and Graben, Rift Valleys,
Major mountain ranges of the world (Rocky Mountains, Appalachians,
Andes, European Alps, Himalayan Range)

4- Volcanic landforms: intrusive igneous rocks (batholiths, plutons, sills, laccoliths, Monadnocks dikes), extrusive igneous rocks (cinder cones, shield volcanoes, stratovolcanoes, caldera, lava domes, volcanic hotspots, volcanic necks, flood basalts

5- Karstic relief :

a) karst environment (Karst and pseudo-karst),

b) karst and pseudo-karst processes: solution and precipitation (limestone, dolomites, evaporites and silicate rocks), slow mass movements and collapses, fluvial and hydrothermal processes,

c) surface and internal karst forms (caves, dolines, ouvalas, lapiez or lapiaz, Poljé, karst springs, karst towers...)

6- Fluvial systems and forms: Fluvial systems and processes

Longitudinal profile and catchment areas, Dams and Lakes.

Mountain streams, braided, meandering or meandering rivers, entrenched meanders, branching rivers, straight rivers, floodplains, river terraces, waterfalls, alluvial deltas...

7- Glacial forms: Alpine ice and glaciers, ice fields and ice caps, Piedmont glaciers, erosion processes and forms (abrasion, erosion, fluvioglacial and glacio-karstic erosion, boulders, glacial cirques, U-shaped glacial valleys, hanging valleys, ridges, horns and passes, locks

and umbilicals. ...) accumulation forms: glacial deposits (lateral, median and terminal moraines, drumlins, erratics...) fluvio-glacial deposits (sandur, eskers, kames, terraces) and glacio-lacustrine deposits.

8- Aeolian patterns: Aeolian environments, shapes shaped by wind erosion (Reg, Hamada, Yardan...), shapes shaped by aeolian deposits (dunes, loess, shoreline dunes and sand sails...)

9- Coastal landforms: coastal environments (swells, waves, currents and tides), erosional coastal landforms (cliffs, abrasion platforms, etc.), forms of coastal deposits (beaches, beach-rock, beach crescents, spits, tombolos, barrier islands, etc.), estuaries, deltas, mangroves.

Practical work

The practical work of Geomorphology is mainly based on the analysis of topographic maps, aerial photographs, satellite images and digital terrain models.

Assessment method

Exam

References :

-Derruau, M. 1994: Les formes du relief terrestre. Masson, Paris, 115 p. -Hugget R.J. 2003: Fundamentals of Geomorphology. Routledge
Fundamentals of Physical Geography, Routledge, London, 386 -Tricart, J. 1977: Précis de

Géomorphologie. Sedes, Paris, 345 p.

-Coque, R. 1977: Géomorphologie. Coll. U, A. Colin, Paris, 430 p.

-Malavoi, J.-R. & Bravard J.-P., 2010: Éléments d'hydromorphologie fluviale. Published by Onema (Office national de l'eau et des milieux aquatiques), 224 p.

Semester 1:

Unit: TEU11

Heading of subject : Computing

Lectures : 1h 30 TUTORIALS : 1h 30

Coeff. 2 Credit. 2

Teaching objectives

The objective of the module is to acquire knowledge on computer hardware and operating systems.

Recommended prior knowledge

No previous knowledge is recommended.

Course content

- Computer hardware

- Introduction to the concept of a computer
- Introduction to computers
- Types of computers
- Constitution of the computer

- Operating systems

- Windows
- Linux

Assessment method :

Exam

References :

(Books and manuals, websites, etc) :

Semester 1:
Unit: TEU11

Heading of subject : Techniques of Expression 1

TUTORIALS : 1h 30

Coeff. 1 Credit. 1

Objectives of the course

This course aims at reinforcing the oral and written expression skills of students in foreign languages, particularly in French and English which are the most common languages of instruction in sciences in Algerian higher education institutions.

Recommended prior knowledge No previous knowledge is required.

Course content :

1-Presentation of the structure of the University, presentation of the LMD system with the objectives clearly explained to the student, supported by examples for a projection in the active life (less than 3 years). -A questionnaire to be filled in during the session, which will allow the teacher to have an initial assessment of the level, expectations, and aspirations of the students.

2- Use of the French language dictionary

About an entry: pronunciation, grammatical category, etymology, different meanings of the word with example sentences / notions of article, reference word, entry, ...

3-Taking notes (from the written or spoken word):

The note-taking process, the different situations, the setting up of the note-taking situation and conditions, the equipment to be provided. Notetaking tools: abbreviations / signs, symbols, acronyms / dashes, arrows, braces / deletions of words / contractions of words / relationship markers / replacements: nominalisation, hypernyms, synonyms, etc.

4- Note-taking exercise based on short sentences and then small written or read texts

and Reminders of the spelling rules for feminine nouns (ending in "-i", "é", "-u", "-ou", "-té and -ité" and the exceptions.

5 - The signs of the French language (accents, cedilla, umlaut)

Using the division into graphic syllables, know how to place (or not) the acute and grave accents in the middle of words/ the exceptions / at the end of a word the grave accent followed by a silent or sound "s" / the different families of words with a circumflex accent/ the cedilla / the umlaut.

6- Choosing the right word: using the right verb for an idea. Series of exercises

a- The "all-purpose" verbs (to make - to say - to have - to give - to see - to put - ...) to be replaced by a precise verb that corresponds exactly to the action.

7- Choosing the right word (continued), series of exercises

b- "Confused" verbs (in the literal and figurative sense) such as: to know and to know / to take - to bring - to bring - to carry - to bring back, ... / to lend (a loan) - to borrow (a loan), ...

8 - Homonymous confusions

Using exercises, go through as many words as possible that are confusing in writing, recalling the nature of the word and the trick that will correspond to the use of different words in the same series of homonyms. This-that / these-that-is-is-knowing / this-that-is-seven-knowing.

9- Instructional verbs

It has been found that many students do not respond to the instructions given in the assessment topics, not necessarily because they do not know the answer, but because they simply do not understand what is being asked of them, what is expected of them, and they do not sufficiently analyse the question asked. In the evaluation statements, the instruction verbs correspond to different activities: observation, location, selection, replacement classification, explanation, presentation, etc.

10- The administrative letter and the envelope

On the basis of a model of the layout of the various fields that make up an administrative letter, present the content of each field: sender, date/place, addressee, reference, subject/formula of attack, development of the subject, politeness/layout of the elements on envelopes to be sent by post or deposited at a secretariat.

11 -Writing a report (of a visit, of a practical work experience, of a mission, of a meeting, etc.): introduction / objective: retain the essential and order the ideas /conclusion / time used / difference between report and report.

-The summary: principle of a summary / structure of a summary / number of words to be respected.

12 - Ordinal and cardinal numerical adjectives and Roman numerals.

Assessment method :

Exam and continuous control

References

(Books and handouts, websites, etc) :

SEMESTER 2

Semester : Erreur ! Signet non défini.
Unit: FEU121 Erreur ! Signet non défini.
Heading of subject : Geology Erreur ! Signet non défini.
Coef. 4 Credit 8 Lectures: 03h00 TUTORIALS : 03h 00

Objectives of the course

The teaching of geology aims at acquiring a basic knowledge of the great phenomena which govern the Earth and to show that this one is an active planet characterized by a dynamic of which it is necessary to try to understand the operation.

Recommended prior knowledge

Notions of geology taught in the course Geology 1 (semester 1).

Course content :

Chapter 1: Materials of the Earth's crust

1.1 Minerals

1.1.1 Basics of Crystallography and Crystal Systems

1.1.2 Mineralogy: Definition of Minerals and Classification

1.2 Rocks

1.2.1 Definitions and main groups of rocks.

1.2.2 Magmatic Rocks

1.2.3 Sedimentary rocks.

1.2.4 Metamorphic rocks

1.2.5 The rock cycle

Chapter 2: External Geodynamics

2.1. Role of water: runoff, ice.

2.2. Role of wind.

2.3 Erosion and isostasy.

Chapter 3: Historical Geology

2.1. Principles of stratigraphy

2.2. Discordances and stratigraphic gaps

2.3. Time in geology: relative and absolute dating

2.4. The stratigraphic scale

Chapter 4: The major structural features of Algeria :

4.1. North-south section of Algeria

4.2 Summary of the structural evolution

Practical work

Petrography, mineralogy and palaeontology :

- Macroscopic determination of some minerals: quartz, calcite, feldspar, amphibole, pyroxene, biotite, muscovite, pyrite, galena, graphite.

- The main groups of rocks

- Magmatic rocks
- Sedimentary rocks
- Metamorphic rocks

- Fossils: Observation and description of some groups **Assessment method :**

Examination and continuous assessment in practical work.

References :

1. Charles Pomerol, Yves Lagabrielle, Maurice Renard, Stéphane Guillot. **Eléments de Géologie.** Dunod. 14ème édition, 2011. 944 pages.
htTutorials://www.elements-geologie.com/

Jean Dercourt , Jacques Paquet, Pierre Thomas, Cyril Langlois. **Géologie : objet, méthodes et modèles.** Dunod. 12ème édition, 2006, 534 pages.

2. Pierre Peycru, Jean-Michel Dupin, Jean-François Fogelgesang, Didier Grandperrin, Collectif. **Géologie : Tout-en-un, 1e et 2e années BCPST.** Dunod. 2008. 641 pages.
3. Alain Foucault, Jean-François Raoult. **Dictionnaire de géologie.** Dunod. 7ème édition, 2010. 416 pages.
4. Denis Sorel, Pierre Vergely. **Atlas d'initiation aux cartes et aux coupes géologiques.** Dunod. 2ème édition, 2010. 120 pages.
5. Alain Foucault, Jean-François Raoult. **Coupes et cartes géologiques.** SEDES. 1975. 150 pages.

Semester : Erreur ! Signet non défini.

Unit: FEU122 Erreur ! Signet non défini.

Heading of subject : Mathematics 2

Coeff. 2 Credit. 4

Lectures : 01h30 Tutorials : 01h30

Teaching objectives

Interpretation of data series, treatment of gaps in the same series and graphic presentation of these interpretations

Recommended prior knowledge.

Statistics

Course content :

- Descriptive statistics: dispersion and position parameters, usual graphical representations.
- Least squares method, regression line, adjustment by power functions
- Parametric statistics: confidence intervals, test of equality of means and equality of variances of two samples.
- Non-parametric tests: Chi-square goodness-of-fit tests, two-sample comparison tests
- Probability: basic vocabulary, elementary probability, conditional probability, discrete random variables, continuous random variables

TUTORIALS :

Application exercises on the theoretical themes of the course

Assessment Method :

Continuous + Examination

References :

N. Piskounov. **Calcul différentiel et intégral. Tome 1.** Editions Mir. 510 pages.

1- Dodge .Y (2003). **Premiers pas en statistiques,** Springer
2- Droesbeke J.J. (1997). **Eléments de statistique,** Editions de l'Université libre de Bruxelles/ Ellipses.
3- Baillargeon G., (1984). **Techniques statistiques,** Edition SMG

Semester: 2
Unit: FEU122
Heading of subject: Physics 2
Coeff. 2 Credit. 3
Lecture: 01h30 Tutorials: 01h30
Objectives of the course

Acquire basic notions on fluid dynamics and : notion of pressure, notion of constraints, relations between constraints and deformations (Hooke's law, Young's modulus, Poisson's coefficient) or between constraints and flow velocities (viscosity).

Recommended prior knowledge Physics 1 of L1;

Fundamental Physics

Course content :

- Notion of pressure,

- Notion of stresses, relations between stresses and strains (Hooke's law, Young's modulus, Poisson's ratio)

-Stresses and flow velocities (viscosity).

-Notion of fluid mechanics

-Fluid dynamics

- Application to simple cases

Bernoulli's, Poiseuille's and Stockes' laws.

-Notions of flow, convection and diffusion, applications to material and energy balances in open systems (Fourier's law).

Tutorials

Exercises on the course chapters

Assessment method:

Exam + continuous control

References

(Books and handouts, websites, etc.) :

Semester : 2

Unit: FEU122

Heading of subject : Chemistry 2
Coeff. 2 Credit. 4
Lectures: 01h30 Tutorials: 01h30

Objectives of the course

This module allows the student to acquire basic notions in thermodynamics and chemical kinetics.

Recommended prior knowledge

Notions of Chemistry acquired in High School.

Course content:

Chapter 1: Introduction to Thermodynamics

-Notion of system, quantities and state function (application to perfect gases)

-1st principle of THD (Energy, work and heat (U,W,Q))

-Thermochemistry (enthalpy and heat of reaction)

-2nd Principle of THD: entropy and free enthalpy.

Chapter II: Chemical kinetics

- Definition, reaction rate, rate laws and order of a reaction

- Factors influencing the speed of reaction:

- Nature of the reactants

- Concentration of reactants

- Concentration and time

- Rate of reaction, collision theory

- Reaction mechanisms

- Catalysts

Chapter III: Chemical Equilibria

- Basic concepts

- The equilibrium constant

- The use of the equilibrium constant

- Factors affecting equilibrium

- Effect of pressure on a system in equilibrium

- Effect of pressure on a system in equilibrium
- The relationship between Kp and Kc

Chapter IV: Physical methods of analysis

- UV visible.
- IR.
- X-RAY

TUTORIALS

N°1 : Thermodynamics

N°2 : Acid-base reactions

N°3 : Redox reactions

N°4 : Reaction mechanisms

N°5 : Chemical kinetics **Assessment method :**

Exam + continuous control

References :

1. Paul-Louis Fabre. **Thermodynamique et cinétique chimique.** Ellipses Marketing, 1998, 224 pages.

2. Boucif BELHACHEMI. **Cours Exercices et problèmes résolus de thermodynamique chimique.** OPU, 2003, 235 pages.

3. N. Chelali. **Cours de thermodynamique et cinétique électrochimique.** OPU, 2004, 134 pages.

Semester 2:

Unit : MEU12

Heading of subject : Biology 2

Coeff. 2 Credit. 4

Lecture : 01h30 Practical work : 01h30

Course content :

Introduction to botany - Definitions, notions and criteria of classification. Systematics of the major groups of the "plant" kingdom followed by general notions of ecology

PART ONE: Algae

1. The algae

    1.1. Prokaryotic algae (Cyanophytes / Cyanobacteria)

    1.2. Eukaryotic algae

    1.3. Morphology

    1.4. Systematics and characteristics of the main groups

PART TWO: Embryophytes

2. Bryophytes : Morphology of the different phyla

    2.1. Morphology

    2.2. Systematics and characteristics of the main groups

    2.3. Bryophytes s. str.

3. Pteridophytes : Morphology of the different phyla

    3.1. Lycophytes

    3.2. Sphenophytes (= Equisetinae)

    3.3. Filicophytes

Gymnosperms sensu lato

    3.4. Morphology

    3.5. Systematics and characteristics of the main groups

4. Angiosperms

    4.1. Morphology

    4.2. Systematics and characteristics of the main groups

PART THREE: General Ecology

CHAPTER I:

1.1. Definition of the ecosystem and its components (Notions of biocenosis and ecological factor)

1.2 Areas of intervention

CHAPTER II: ENVIRONMENTAL FACTORS

2.1. Abiotic factors

- Climatic

- Edaphic

- Hydric

2.2. Biotic factors

- Competition

- Pests and Predators

- Cooperative and symbiotic interaction

- Parasitism

2.3 Interaction of environments and living beings

Practical work :

Session 1: Algae (Phycophytes) : Morphology and reproduction of some species such as Ulva lactuca and Cystoseiramediterranea.

Session 2: Bryophytes: Morphology and reproduction of Bryum sp.

Session 3: Pteridophytes: Morphology and reproduction of Polypodiumvulgare and Selaginelladenticulata

Session 4: Cycadophytes : Morphology and reproduction of Cycas revoluta

Session 5: Coniferophytes (Gymnosperms sensu stricto) : Morphology and reproduction of Pinushalepensis and Cupressus sempervirens

Session 6: Floral morphology of Angiosperms Monocotyledons on examples such as Asphodelus (or Allium)

Assessment method:

Exam+Continuous control

Semester 2:
Unit: MEU 12
Heading of subject : Introduction to Geological Mapping
Coeff. 2 Credit. 4
Lecture: 01h30 Practical work: 01h30
Course content :

I. BASIC DEFINITIONS

II. THE GEOLOGICAL MAP

1- Terrain notation

a) sedimentary terrains

b) magmatic terrains

c) metamorphic terrains

2 - Notation of structures

3 - Other conventional signs

4 - Note on the map

III. THE GEOLOGICAL SECTION

1- Principle

2- Conventional figures

IV. GEOMETRIC PROPERTIES OF LAYERS

1- Dip and direction of a layer

2 - Real and apparent thickness

V. REPRESENTATION OF GEOLOGICAL LAYERS

VI. GEOLOGICAL STRUCTURES

1- Tabular structures

2- Monoclinal structures

3- Folded structures

4- Faulted structures

5- Discordant structures Practical work **:**

Geological mapping

- Presentation of a geological map,

- Production of geological sections

Assessment method : Exam + continuous control

Semester 2:

Unit: TEU12

Heading of Subject : Computing 2

Coeff. 2 Credit. 2

Lecture: 01h30 TUTORIALS : 01h30

Teaching objectives

The objective of the module is to acquire knowledge of office automation software and the Internet.

Recommended prior knowledge

Notions acquired in the module Computer Science 1 (semester 1).

Course content :

- Office software

❑ Word processing

❑ Excel,

- The Net

❑ The Internet Intranet

❑ The WEB

❑ Internet navigation

❑ Online course formats (e-Learning)

Assessment method :

Exam

Semester 2:

Unit: TEU12

Heading of subject : Techniques of Expression 2

Coeff. 1 Credit. 1

Tutorials : 01h30

Objectives of the course

This course aims at reinforcing the oral and written expression skills of students in foreign languages, particularly in French which is the most common language of instruction in sciences in Algerian higher education institutions.

Recommended prior knowledge

Notions acquired in the module Techniques of expression 1 (semester 1).

Course content :

- Word formation

This course is mainly in the form of exercises, with the emphasis on the Earth Sciences language as examples of words to be worked on: origin of words (etymology) / formation of words (root, radical) / word family (prefix, suffix).

and the silent letters at the end of words by learning to find a word of the same family justifying the silent letter.

- The meaning of words.

In the form of exercises, the following will be addressed: nature of words (nouns, verbs, adjectives, ...) / meaning of words (proper, figurative, polysemy) / nuances of meaning of a word (synonymy) / similarities of words (homonyms, paronyms) / words with opposite meanings (antonyms).

The style of the sentence:

This course will cover the following topics: the elements of the sentence / types of sentences / sentence forms / active, passive and pronominal voices / nominalisation.

- Introduction to Bibliographic Research

- objective / notion of plagiarism

- understanding of the subject to be dealt with (defining the key words, the areas of research, etc.)

- identification, location and research of documentary tools (library, files, data banks, different types of documents, etc.)

- use of information (bibliographic sheet, note-taking, summaries, summary notes, photocopies, etc.)

- Bibliographic references: writing rules for different types of documents (monographs, chapters in documents, journal articles, dissertations, electronic documents, etc.)

Application: for a specific subject (without dealing with the subject) the student will have to look for bibliographical references.

SEMESTER 3

Semester 3:
Unit: FEU311
Heading of subject : Crystallography
Coeff. 3 Credit. 6
Lecture : 01H30 Tutorials : 03h00
Teaching objectives

The student is expected to know all crystal systems, their geometry, their symmetry elements and the different modes and classes to which they belong.

Recommended prior knowledge

The student must know the basic elements of crystallography, taught in the 1st year of Geology.

Course content :

I. Geometric crystallography

- Definition of geometrical states of matter.
- Fundamental laws of crystallisation.
- Geometrical study of point networks.
- Orientation symmetry.
- The 32 classes of symmetry.
- The 7 crystal systems.
- The 14 Bravais lattice modes.
- Definition of a crystal form (examples).
- Other vector properties

II. Crystalline optics

- Reminder of optics.
- Propagation of light in a crystalline medium.
- Refractive index.
- Birefringence.
- Indicators.

Practical work:

Definition of the crystalline state. Manipulation of wooden models: symmetry elements.

1- Research of the different symmetry elements on wooden models, relationship between the symmetry elements, writing the symmetry formula.

2- Principle of the projection of symmetry elements, application on models.

3- The 32 classes of symmetry, projection of the different classes with direct axes.

4- The 32 classes of symmetry (continued), projection of the inverse axes and other classes, highlighting the holohedra and hemihedra.

5- Definition and manipulation of the simple shapes of the lower and intermediate systems (dihedral, pyramids, prisms...)

6- 3-axis indexing and manipulation

7- Cubic system: projection and nomenclature of simple shapes.

8- 4-axis indexing (hexagonal and rhombohedral systems).

9- X-rays: study of diffractograms of minerals.

Assessment method :

Examination and continuous assessment.

References :

Delepine, C. (1971) : 'Introduction à la cristallographie', Dunod, Paris.

Flint, E. (1981) : 'Principes de cristallographie', Edition MIR, Moscou.

Gay, R. (1959) : 'Cours de cristallographie, Livre I : Cristallographie géométrique', Gauthier-Villars.

Hammond, C. (1990): 'Introduction to cristallography', Oxford Univ. Press, New York.

Hladik J. (1995) : La théorie des groupes en physique et chimie quantique – Masson,

International Tables for Crystallography, Volume A, Edited by Theo Hahn, by Kluwer Academic Publishers. 1983

Mooser, E. (1993) : 'Introduction à la physique des solides', Presses polytechniques et universitaires romandes, Lausanne.

Ouahas, R. (1984) : 'Eléments de radiocristallographie', Ed. PublisudParis, OPU.

Roubault, M. (1963) : 'Détermination des minéraux des roches au microscope polarisant', Editions Lamarre-Poinat, Paris.

Rousseau, J.-J. (1995) : 'Cristallographie géométrique et radiocristallographie avec exercices corrigés', Edition Masson, Paris.

Schwarzenbach, D. (1993) : 'Cristallographie', Presses polytechniques et universitaires romandes.

Sirotine Y.et Chaskolskaia, M. (1984) : 'Fondements de la physique des cristaux', Edition MIR, Moscou.

Sivardière, J. (1995) 'La symétrie en *Mathématiques, Physique et Chimie', PUG, Grenoble.

Van Meerssche M. et Feneau-Dupont, J. (1984) 'Introduction à la cristallographie et à la chimie structurale', Peeters Press, Louvain.

Verbaere, ‘A. (1985) : Symétrie et état cristallin’, Cours DEA, Université de Nantes, France.

Weigel, D. (1971) : ‘Cristallographie et structure des solides, Tome 1 :
Algèbre et géométrie cristalline et moléculaire’, Edition Masson et Cie.

Semester 3 :

Unit: FEU312

Heading of subject : Mineralogy

Coeff. 3 Credit. 6

Course : 01H30 Lab practices : 03h00

Objectives of the course

The student is expected to know the different mineral classes, with their physical and chemical characteristics.

Recommended prior knowledge

The student must know the basic elements of mineralogy, taught in the 1st year of Geology.

Course content :

Chapter I: Basics of crystallochemistry

Reminder of the structure of the atom and chemical bonds

Reminder of some definitions (crystal, mineral etc...)

Definition of co-ordination, isotyping, isomorphism and polymorphism

Chapter II: Classification of minerals (the nine groups)

1- Class of native elements.

2- Class of halides.

3- Class of sulphides and sulphosalts.

4- Class of oxides and hydroxides.

5- Classes of carbonates...

6- Sulphate classes...

7- Phosphate class...

8- Silicate class

9- Borate class

Practical work :

Definition of a mineral, optical and physical properties.

(density.....)

1- Class of native elements.

2- Class of halides.

3- Class of sulphides and sulphosalts.

4- Class of oxides and hydroxides.

5- Carbonate classes...

6- Sulphate classes...

7- Phosphate class...

8- Silicate class

9- Borates

Assessment method :

Exam and continuous control

References

-Claude Guillemin, Guy Aubert, Roland Pierrot. Précis de minéralogie**.** Edition Droz 1960. 224 pages.

-Michel Demange. Les minéraux des roches (caractères optiques, composition chimique, gisement). Presse des Mines, 2009, 194 pages. -J. Aubouin, R. Brousse, J.P. Lehman, Précis de géologie. Tome 1 :
pétrologie**.** Dunod, 1968. 712 pages.

Semester 3 :
Unit: FEU 321
Heading of subject : Tectonics 1
Coeff. 3 Credit. 6
Course : 01H30 Lab practices: 03h00
Objectives of the course

This course allows students to know the different tectonic structures and orogenic cycles that affect the lithosphere.

Recommended prior knowledge

The student is supposed to have acquired the basic knowledge on tectonics in the Geology course, in the 1st year.

Course content :

Introduction: Basics of the Earth's crust and lithosphere

- Continental crust

- The oceanic crust

- Lithosphere and isostasy

Part 1: Continental structures

Chapter 1: Shields and Platforms

Chapter 2: Sedimentary basins

- Collapse troughs: rifts

- Basins proper

- Mixed basins

Chapter 3: Crustal Fissures

Chapter 4: Continental Margins

- Passive margins

- Active margins and drifting island arcs

Chapter 5: Mountain Ranges

- Intracontinental Ranges

- Intercontinental Ranges

Part Two: Oceanic Structures

Chapter 1: Seismically Active Oceanic Ridges

- Ridges

- Island arcs

Chapter 2: Seismically Inactive Oceanic Landforms

- Volcanic landforms - Non-Volcanic Landforms

Practical work :

1- Reminder of cartographic notions

Determination of the altitudes of planar surfaces on a cartographic support: Intersection of topographic surfaces and layer boundaries

2- Tabular and monoclinal structures

3- Exercises and corrections on geological maps (reports)

Assessment method :

exam + Continuous control

References

« La Tectonique des plaques vingt ans après », 1990 : in *Universalia 1990*, pp. 156-161, Encyclopædia Universalis, Paris,

Aubouin J., 1980 : « De la tectonique des plaques à la genèse des chaînes de montagnes », in *Livre jubilaire de la Société géologique de France*, mémoire hors série n° 10, pp. 163-180,

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Condie C. K. , 1988: *Plate Tectonics and Crustal Evolution*, Pergamon Press, Oxford, 3e éd.

Conrad J., 1984: Les séries carbonifères du Sahara central algérien. Stratigraphie, Sadimentation, Evolution structurale. Thèse sciences, Univ.
Marseille 3, France, 370p.
Delfaud J., 1974 : Les grands traits de la paléogéographie de l'Algérie septentrionale durant le Jurassiqu supérieur et le Crétacé inférieur. CR somm. Soc. Géol. France 6, 167-178.

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Yves Missenard, Jacques Mercier, Pierre Vergely. Tectonique. Dunod, 2011 - 3ème édition - 232 pages –

J. Aubouin, R. Brousse, J.P. Lehman, Précis de géologie. Tome 3 : tectonique, tectonophysique, morphologie. Dunod, 1979. 759 pages.

Semester 3:

Unit: MEU311

Heading of subject : Stratigraphy

Coeff. 2 **Credit. 4**

Lecture : 01H30 **Tutorials : 01h30**

Teaching objectives

The student is supposed to be able to give a chronological order of the various geological events on the scale of sedimentary basins and others. They will therefore be able to order them in a chrono-stratigraphic and palaeogeographic framework.

Recommended prior knowledge

The student is expected to have acquired the basic knowledge of stratigraphy in the Geology course in the 1st year.

Course content :

Time in geology

1.1. Relative dating

1.2.1. Chronological and geometrical order

1.2.2. Principles of stratigraphy

1.2.3. Biostratigraphic zonation

1.2. Absolute dating

1.2.1. Radiochronology

1.2.2. Geochemical geochronology

2. Stratigraphic units

2.1 Introduction: The major geological periods

2.2. Stratotypes

2.3. Lithostratigraphy

2.4. Biostratigraphy

2.5. Chronostratigraphy

2.6. Relationship between litho-, bio- and chronostratigraphy

3. Rythmostratigraphy

3.2. Sequence analysis

3.3. Eustatism and eustatic cycles

4. Subsidence, transgressions and regressions 4.1.

4.2. Isostasy

4.3. Tectonic subsidence

4.4. Transgressions and regressions

5. Paleogeography

5.2. Facies variations 5.3.

5.3. Isopaque and isobaths

5.4. Physical and chemical factors in the palaeoenvironment

5.5. Palaeoecology

6. Paleogeographic and geodynamic evolution

Tutorials :
- Exercises on the principles of stratigraphy
- Typical section and exercises
- Correlation of sections and lithostratigraphic log at different scales,
- Isopaque and isobate maps,

Assessment method :
Examinand continuous control.

References

Aubouin J.,Brousse R. et Lehman L.P. (1978) : Précis de Géologie tome 2 Paléontologie et Stratigraphie, Edition Dunod Paris.

Boulin J. – 1977 : Méthodes de la stratigraphie et géologie historique. Masson Ed.

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Perrondon A.- 1972 : Méthodes et tendances de la stratigraphie.
Conclusions et essai de synthèse. B.R.G.M., Mémoir 77.

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Pomerol Ch. et Babin C., (1977) : Précambrien, ère paléozoïque. Stratigraphie et paléogéographie, Paris, Doin édit., 430 p.
Termier H. et G., (1960) : Paléontologie stratigraphique, Paris, Masson édit., 516 p.

Semester 3:

Unit: MEU 312

Heading of Subject : Palaeontology

Coeff. 3 Credit. 5

Course: 01H30 Lab practices : 02h30

Objectives of the course

This course allows the students to know the different fossil groups, their systematics, their evolution, as well as their stratigraphic and paleoecological interest.

Recommended prior knowledge

The student is supposed to have acquired the basic knowledge of palaeontology in the Geology course, in the 1st year.

Course content

I. Introduction: definition and generalities of Paleontology

II. The processes of fossilization

III. Reminders of Systematics

IV. Study of some groups of fossils

- techniques of collection and study
- study of some groups of vertebrates
- study of some groups of protists and invertebrates
- study of some groups of plants

V. Relationships of fossil studies in Stratigraphy and Paleontology

VI. Notion of evolution, taxonomy, examples of some evolutionary groups

VII. Notions of Ecology

Practical work :

Study of fossil groups (macro-Paleontology).

- Arthropods
- Molluscs
- Brachiopods
- Cephalopods
- echinoderms
- Fossil plants

Assessment method :

Examination and continuous assessment in practical work.

References

Auboin J.,Brousse R. et Lehman L.P. ,1978 , Précis de Géologie tome 2
Paléontologie et Stratigraphie, Edition Dunod Paris

Aubouin J., Brousse R. et Lehman J.-P., (1975) : Précis de géologie, Paris, Dunod édit, 3e éd., 3 vol., 718 p., 480 p., 720 p.

Babin C, (1971) : Eléments de paléontologie, Paris, Armand Colin édit., 408 p.
Beaumont G. (1973) : Guide des Vertébrés fossiles, Neuchâtel, Delà-chaux & Niestlé édit., 476 p.
Claude Babin (1971) : Eléments de Paléontologie, Édition Armand Colin Collection U Sciences

Claude Babin (1971) : Eléments de Paléontologie, Édition Armand Colin Collection U Sciences

Denandre G., (1967) : La vie créatrice de roches, Paris, Presses Universitaires de France édit., coll. « Que sais-je? », 7e éd., 128 p. Furon R., (1943) : La paléontologie. La science des fossiles, son histoire, ses enseignements, ses curiosités, Paris, Payot édit., 216 p.
Moret L., (1966) : Manuel de paléontologie animale, Paris, Masson édit., 5e éd., 782 p.
Pomerol Ch. et Babin C., (1977) : Précambrien, ère paléozoïque. Stratigraphie et paléogéographie, Paris, Doin édit., 430 p.
Pomerol Ch., (1973) : Ere cénozoïque (Tertiaire et Quaternaire). Stratigraphie et paléogéographie, Paris, Doin édit., 384 p.
Pomerol Ch., (1975) : Ere mésozoïque. Stratigraphie et paléogéographie, Paris, Doin édit., 384 p.
Pomerol Ch., Babin C., Lancelot Y., Le Pichon X. et Rat P., (1980) : Stratigraphie et paléogéographie, principes et méthodes, Paris, Doin édit., 212 p.
Raymond En (1990) : Paléontologie des invertébrés, Édition Dunod
Collection Géosciences
Roger J. Paléontologie générale, 1974, Édition Masson

Termier H. et G., (1960) : Paléontologie stratigraphique, Paris, Masson édit., 516 p.
Traité de paléobotanique, publié sous la direction de E. Boureau, Paris, Masson édit., 1964-1970.
Traité de paléontologie, publié sous la direction de J. Piveteau, 7 t., Paris,Masson édit., 1952-1969.

Semester 3:

Unit: TEU 311

Heading of subject : Database management and GIS.

Coeff. 2 Credit. 2

Lecture : 01H30 Tutorials : 01h30

Teaching objectives

This course enables students to enter, process and model geographical data, spatially located, by software.

Recommended prior knowledge

To be able to master the computer tool and the basic notions in geography.

Course content :

Chapter 1:

1- Notion of databases

1-1- Definition, role of a DBMS.

2- Principles of relational databases

2-1- Definition of the table, definition of entities:

- Notion of primary key - Relations and their cardinality

2-2- Concept of data models:

- Conceptual data models (CDM), logical models (LDM),

Physical models (MPD).

2-3- Notion of joins

3- Setting up a database

3-1- Illustration of the interest of a database

3-2- Structuring and setting up an Access database from Excel data.

4- Designing a database

4-1- Preliminary reflections, needs analysis, creation of data models

5- Creation of the database in Access

5-1- Creation of tables, keys, relations and queries.

6- Links between GIS and databases

6-1- Implementation of O.D.B.C. (Object Data Base Connectivity) link procedures.

6-2- Theoretical principle and practical demonstration:

- links between Access and GIS software.

7- The S.Q.L language

7-1- Language for querying and creating relational databases

7-2- The main query commands :

- selections, joins, subqueries.....

7-3- Practice of the language :

- Access in L.Q.S mode on a simple database

- SQL queries in GIS software

8- Specificity of GIS :

- Spatial queries

-Illustration on a GIS software

Chapter 2:

1- Basic concepts of GIS 1-1- Definition of GIS : - Geographic Information - Historical background.

1-2- The functions of a GIS :

- Acquisition
- Data management
- Data processing
- Restitution.
- Hardware and software
- Organisations involved in GIS

2- Georeferencing

2-1- Concept of projection systems:

Lambert NTF/Lambert93.

2-2- Principle of georeferencing:

- Calibration points
- RMS error

3- Data representation and structuring

3-1- Data representation modes:

- Vectors/Raster.

3-2- Graphical data structuring:

- Topological and non-topological mode.

3-3- Attribute data structuring:

- Joins

- Thematic analysis

4- Available digital data

4-1- Reference data :

- Large-scale reference frame (RGE IGN)

- INSEE data

- Land register.

4-2- Thematic data

TUTORIALS :

- Application of the concepts covered

- Design, creation and updating of a database, then link with a GIS

- Practical example of the joint use of GIS and DBMS

Assessment method :

Exam +continuous control

Semester 3:

Unit : TEU312

Heading of subject : English Language

Coeff. 1 Credit. 1

Tutorials : 01H30

Objectives of the course

The student is expected to learn the basics of the English language (grammar, conjugation) and terminology.

Recommended prior knowledge The notions of English

acquired at the Lycée.

Course Content :

Classes focusing on technical English and conversational practice.

Assessment method: Examination

SEMESTER 4

Semester 4:

Unit: FEU411

Heading of subject : Petrology of Magmatic Rocks

Coeff. 3 Credit. 5

Lecture : 01h30 **Practical work : 03H00**

Objectives of the course

The aim is to master the different minerals and the classification of magmatic rocks, as well as the phenomena at the origin of their formation.

Recommended prior knowledge

To master the petrography part of the geology module of L1.

Course content

1- Introduction, reminders of L1

2- Methods of study of magmatic rocks

3- Minerals of magmatic rocks and their order of appearance

4- Origin of magmatic rocks and how they are deposited

5- Crystallization and evolution of magmas

6- Classification of magmatic rocks

Mineralogical classification

Chemical classification

7- Major groups of magmatic rocks

Plutonic rocks

Intermediate rocks

Volcanic rocks

8- Alteration of minerals in magmatic rocks

Practical work (12 sessions)

1st part

-Presentation of the microscope

-Notions of crystallographic indices

-Study in natural and polarized light

-Study in polarised-analysed light

Part II: minerals

-Cardinal minerals: Quartz; feldspars; feldspathoids

-Essential minerals: peridots; pyroxenes; amphiboles; micas; chlorites.

-Accessory minerals: zircon, apatite, sphene, garnets; epidotes; tourmaline; spinels; calcite.

-Textures of magmatic rocks

-Nomenclature of magmatic rocks based on their mineralogy.

Assessment method :

Examination and continuous assessment.

References

1. J. Aubouin, R. Brousse, J.P. Lehman, **Précis de géologie. Tome 1 : pétrologie.** Dunod, 1968. 712 pages.
2. Bernard Bonin, Jean-François Moyen. **Magmatisme et roches magmatiques.** Dunod, 3ème édition, 2011, 313 pages.
3. Jean-Claude Pons. **La pétro sans peine 1 : minéraux et roches magmatiques.** CRDP de l'académie de Grenoble, 2000, 257 pages.
4. William S. MacKenzie, Anthony E. Adams. **Initiation à la Pétrographie.** Dunod, 2005, 192 pages.
5. Jean-François Beaux, Bernard Platevoet, Jean-François Fogelgesang. **Atlas de Pétrologie**. Dunod, 2012, 144 pages.

Semester 4:

Unit: FEU412

Heading of subject : Petrology of Sedimentary Rocks

Coeff. 2 Credit. 4

Lecture : 01h30 Practical work : 03h00

Teaching objectives

The students must learn to recognize and classify the different sedimentary rocks.

Recommended prior knowledge

To master the petrography part of the geology module of L1.

Course content :

1. Introduction
    - 1.1. Definitions
    - 1.2. Genesis of sedimentary rocks
    - 1.3. Sedimentation media
    - 1.4. Classification of sedimentary rocks
    - 1.5. Minerals in sedimentary rocks
2. Detrital rocks
    - 2.1. Conglomerates
    - 2.2. Sandstone
    - 2.3. Clays
3. Carbonate rocks
    - 3.1. Introduction
    - 3.2. Limestone
    - 3.3. Dolomites
4. Evaporites
    - 4.1. Different evaporite salts
5. Phosphates
    - 5.1. Continental phosphates

5.2. Marine phosphates

6. Siliceous rocks

6.1. Flints and cherts

6.2. Radiolarites

6.3. Diatomites

7. Ferruginous rocks

7.1. Oxide ores

7.2. Iron carbonates

8. Carbonaceous rocks

8.1. Coals

8.2. Oil

Practical work :

- Minerals of sedimentary rocks
- Soft rocks: pebbles, gravels, sands etc.
- Silicoclastic rocks: textures, classification, morphoscopy of grains and cements, classifications
- Carbonate rocks: elements, binding phase, classifications: Dunham and Folk
- Other rocks: examples of phosphate rocks, ferruginous rocks etc.

Assessement method :

Exam+continuous control

References

Frédéric BOULVAIN. Pétrologie sédimentaire. Des roches aux processus. Ellipses, 2010, 259 pages.

A-E. Adams, William Mackenzie, C Guilford. Atlas des roches sédimentaires. Masson, 1994, 104 pages.

Semester 4:

Unit: FEU421

Heading of subject : Tectonics 2

Coeff. 3 Credit. 5

Lecture: 01h30 Lab practices: 03H00

Teaching objectives

The student is expected to learn the basics of structural analysis.

Recommended prior knowledge

The notions of tectonics 1 acquired in semester 3.

Course content :

Chapter 1- Notions of stress and strain

1- Notions of force and stress

2- Notions of deformation

3- Origin of stresses

Chapter 2- Non-tectonic deformations

2.1-Creep

2.2 -The landslide

Chapter 3- Tectonic deformation

3.1-Continuous deformation: folds

- Monoclinal structures

- Folds

    Elements of a fold

    Classification of folds

3.2- Discontinuous deformation: faults

- Elements of a fault

- Nomenclature of faults

- Shear joints, tension cracks and diaclases

    3.3- Fault sheets

    3.4- Concept of microtectonics

Practical work

Faulted structures

Unconformity structures

Commentary of geological sections and maps with complex structures

Assessment method :

Examination and continuous control

References

Arthaud F., 1969, Méthode de détermination graphique des directions de raccourcissement, d'allongement et intermédiaire d'une population de failles. Bull. Soc. Géol. France ; 7° ser., t. XI, 729-737.

Arthaud F., 1970, Etude tectonique et microtectonique comparée de deux domaines hercyniens : les nappes de la Montagne Noire (France) et l'anticlinal de l'Iglesiente (Sardaigne). Thèse Doct. Etat. Univ. MonTutorialsellier, 175p.

A. Nicolas .1989, Principes de tectonique

Choukroune P., 1971, Contribution à l'étude des mécanismes de la deformation avec schistosité grace aux cristallisations syncinématiques dans les zones abrités (pressure shadows). Bull. Soc. Géol. France ; 7° ser., t 13, n° 3-4, 257-271.

Gruneisen P. et al., 1973, Analyse de la fracturation naturelle d'une structure plissée. Fracturation de la couverture calcaire de structures diapiriques. Sci. Géol. Bull. Strasbourg, 26, 2/3, 161-186 et 187-217.

Mattauer M., 1973, Les déformations des matériaux de l'écorce terrestre. Hermann Ed. Paris, 493p.

Nicolas A. -1989, Principes de tectonique, Masson, 2° éd., Paris, 223p.

Nicolas A., Bouchez J. L. et Boudier F., 1972, Interprétation cinématique des déformations plastiques dans le massif de Lanzo (Alpes piémontaises). Comparaison avec d'autres massifs. Tectonophysics, 14, 143-171.

Price N. J., 1966, Fault and joint development in brittle and semi brittle rock. Pergamon Press. Ed. Lodon, 176p.

Ragan D. M. – 1973, Structural geology. An introduction to geometrical techniques. Wiley, édi., New York.

Ruhland M., 1973, Méthode d'étude de la fracturation naturelle des roches associée à divers modèles structuraux. Sci. Géol. Bull. Strasbourg, 26, 2/3, 91-113.

Vialon P., Ruhland M. et Grolier J.- 1976, Eléments de tectonique analytique. Masson éd. Paris, 118p.

Semester 4:

Unit: FEU 422

Heading of subject : Micropalaeontology

Coeff. 3 Credit. 5

Lecture : 01h30 Lab practices : 03H00

Teaching objectives

Knowledge of micropalaeontology: age, sedimentation environments, study methods

Recommended prior knowledge

To have followed the courses of the first two years.

Course content :

Part I:

1.1 Introduction

- Definitions& Generalities on micropalaeontology, microfossil,...etc.
- its purpose: what is the purpose of micropalaeontology and the study and relationship with other disciplines of geology and other sciences, - history of micropalaeontology: give a brief overview of the science.

1.1 Techniques or methods of studying microfossils: give an overview of the field: how to do it: o Collecting material o Preparation of material o Observation of microfossils o Determination of microfossils

Part 2:

Interest and use of micropaleontology

2.1. Paleobiological and geological exploitation

2.2. Microfossils in their fossilising environment of the living microfossil

the setting up of deposits the fate of microfossils in the deposits

2.3. Microfossils, key to biological problems from ecology to palaeoecology species and speciation the modalities of evolution microfossils and the origin of life

2.4. Microfossils as a source of sediments lithogenesis by biclastic accumulation lithogenesis by concentration of amorphous substances from organisms lithogenesis linked to microbiotic activity

2.5. Microfossils, a chronometer of Phanerozoic time microfacies biozones and biozonations

 biostratigraphy, chronostratigraphy, magnetic inversions and radiometric dating

2.6. Microfossils as witnesses of environments and geographies from paleoecology to the reconstruction of paleoenvironments

 microfossils, evidence of oceanic expansion from paleobiogeography to global paleogeographies

Practical work

Study of different groups of microfossils

References

-Bignot G. 2001 : Introduction à la micropaléontologie. Gordon and Breach.

-Haynes J. 1981 : Foraminifera. Mac Millan

Semester 4:

Unit : MEU 411

Heading of Subject : Basic Geochemistry

Coeff. 3 Credit. 5

Lecture : 01h30 Lab practices : 02H30

Description:

To introduce the student to the notions of general chemistry and to the different techniques of physicochemical analysis of solutions.

Course content :

Chapter I Introduction

- definitions and generalities

- reminder of the different types of chemical bonds

- periodic classification of elements

- concept of crystallochemistry

- Isomorphism and polymorphism

- Rules of diadochic substitution

- Structural formulae of minerals Chapter II Distribution laws of elements

- Major elements and trace elements :

- Notions of compatible and incompatible elements

- Notions of partition coefficient

Chapter III: Laws and Types of Radioactivity

Chapter IV Isotopic Geochemistry

- Stable isotopes

- Unstable isotopes

Practical work :

Geochemistry of elements (stable and unstable isotopes)

Geochemistry of solutions (Carbonates....)

Geochemistry of solids

- Practical work: Sample preparation techniques for isotope analysis

- Application exercises: Absolute dating, Reconstitution of temperature, salinity etc.

Semester 4:

Unit: MEU412

Heading of subject : Practical Fieldwork

Coeff. 2 Credit. 4

Objectives of the course

The aim of this module is to learn the methods of surveying stratigraphic sections and mapping in sedimentary terrain.

Recommended prior knowledge

Petrography of sedimentary rocks, stratigraphy and tectonics.

Course content :

- Introduction to location, topographic map, use of the compass. Introduction to geological mapping.

-Survey of lithological sections: keeping a field notebook, description of facies, measurement of thicknesses, log stratigraphy and section with dip of the layers

- Recognition of geological structures and formations

-Writing of a geological report **Assessment method :**

Note of the internship report.

References

Frédéric Boulvain, Jacqueline Vander Auwera. Géologie de terrain. De l'affleurement au concept. Ellipse, 160 pages.
Denis Edwin Beeching Bates, John Francis Kirkaldy. La géologie de terrain. Guide Nathan, Edition : F. Nathan, 1977, 248 pages.

Semester 4:

Unit: DEU 411

Heading of subject : Geophysics Coeff. 2 Credit. 2

Lecture : 01h30 Tutorials : 1h30

Teaching objectives:

- To familiarize the student with the physics of the Earth.
- To introduce the student to non-destructive prospecting methods.

Recommended prior knowledge:

- Good knowledge of Mathematics and Physics.
- General geology.
- Basics of Tectonics.

Course content :

- I. Basic concepts:
  - I.1 Introduction ;
  - I.2 what is geophysics; I.3;
  - I.3 Objectives of geophysics ;

1.4. Physical properties of rocks.

- II. Methods of geophysical prospection: Basic principles; objectives; choice of methods.

III.1 Seismic methods (seismic refraction and seismic reflection);

II.2 Gravimetric prospecting;

II.3 Electrical methods;

II.4 Electromagnetic surveying.

- Exercises and applications concerning the course

Assessment method : Exam

References

Dubois J. & Diament M. (2005). Géophysique : cours et exercices corrigés. Dunod, 227 p.
Mari J.
L., Arens G., Chapellier D. (1998). Géophysique de gisement et de génie civil. Technip, 467 p.

Semester 5

Semester 5:

Unit: FEU 511

Heading of subject: Petrology of Metamorphic Rocks

Coefficient: 3 Credit: 5

Lectures: 01h30 Labs: 03h00

Teaching Objectives:

The objective of this course is to provide students with the necessary elements to study metamorphic rocks (definitions, phase rules, graphical representation, metamorphic facies, etc.).

Recommended prerequisites:

Mastery of the petrography section of the geology module in L1 as well as courses in crystallography and mineralogy.

Subject Content:

Lectures:

- Definition of metamorphism
- Factors of metamorphism
- Geodynamic context of metamorphism
- Different types of metamorphism
- Local metamorphism
- General or regional metamorphism
- Metamorphic facies
- In contact metamorphism
- In general metamorphism
- Classification and nomenclature of metamorphic rocks.

Laboratory Work:

Recognition of structures of metamorphic rocks (schistosity, foliation).

Recognition and **description of metamorphic rock facies.**

Assessment:

Exams and continuous assessment.

References

J. Aubouin, R. Brousse, J.P. Lehman, Précis de géologie. Tome 1 : pétrologie. Dunod, 1968. 712 pages.

Jean-Claude Pons. La pétro sans peine 2 : minéraux et roches métamorphiques. CRDP de l'académie de Grenoble, 2002, 240 pages. William S. MacKenzie, Anthony E. Adams. Initiation à la Pétrographie. Dunod, 2005, 192 pages.

Jean-François Beaux, Bernard Platevoet, Jean-François Fogelgesang. Atlas de Pétrologie. Dunod, 2012, 144 pages.

Semester 5:
Unit: FEU 512
Heading of subject: Sedimentology
Coefficient: 4 Credits: 7
Lecture: 3 hours **Practical: 3 hours**

Teaching objectives:
The objective of this course is to describe the different sedimentary depositional environments, including continental, mixed, and marine, with their respective characteristics and sequences.

Recommended prerequisites:
Knowledge of sedimentary rock petrography.

Subject content:
Lectures:

I. Introduction Sedimentary rocks
Sedimentary basins

II. Siliciclastic environments
Introduction
Depositional environments of detrital rocks
2.1. Deposits of debris cones
2.2. Aeolian deposits
2.3. Fluvial deposits: Fluvial dynamic phenomena and fluvial sedimentation
2.4. Coastal deposits
• Submarine and littoral morphology
• Current dynamic phenomena and marine sedimentation
• Dynamics of mouth zones and sedimentation near estuaries
2.5. Continental shelf deposits
2.6. Basin deposits and turbidites

III. Carbonate environments
Generalities
Depositional environments of carbonates
• 2.1. Lacustrine carbonates
• 2.2. Temperate carbonate platforms
• 2.3. Tropical carbonate platforms
• 2.4. Reef margins
• 2.5. The slope
• 2.6. The basin

IV. Evaporitic environments
Introduction
Continental evaporites
Shallow marine evaporites

Deep evaporites **Practical work:**

- Introduction to the analysis of loose sediments: sand granulometry.
- Graphical representations and calculation of sedimentological parameters.
- Method of studying rudite sediments: (morphometry, graphical representation, and calculation of sedimentological parameters)
- Method of studying fine sediments
- Granulometric analysis of mudstones using the Andersen pipette method
- Sediment evolution indices (Rivière indices) and interpretation of results
- Introduction to the study of clay minerals, preparation, and X-ray analysis of samples
- Processing and treatment of diffractograms.
- Facies mapping: sand and mudstones.

Assessment:

Exams and continuous assessment.

Bibliography

Allen J.R.L. (1970) : Physical processus of sedimentation. Amer. Elsevier Pub. Co. Inc. New York, 248p.
Allen J.R.L. (1977): Physical processes of sedimentation, Allen and Unwin, London, 248p.
Allen J.R.L. (1982): Sedimentary structures: their character and physical basis. Developments in sedimentologie 30, Elsevier, 2 Vol., 663p. Chamley H. (1986) : Continental and marine paleoenvironments expressed by the west Pacific clay sedimentation. Geol. Rundschan, 75, 1, 271-285 Chamley H. (1987) : Sédimentologie. Collection géosciences. Dunod. 174p.
Collinson J.D. and Lewin J. :1984: Modern and ancient fluvial systems. Inter. Assoc. Sediment., Special publications 6, 575p.
Collinson J.D. and Yhompson D.B. (1982) : Sedimentary structures.
George Allen and Unwin, Boston, 194p.
Fernandez J., Bluck B.J. and Viseras C. (1993) : The effect of fluctuating base level on the structure of alluvial fan and associated fan delta deposits : an example from the Tertiary of the Betic Cordllera Spain. Sedimentology,40, 879-813.
Galloway W.E. and Hobday D.K. (1983) : Terrigenous clastic depositional systems. Springer-Verlag, New York, 423p.
Miall A.D. (1978) : Fluvial sedimentology. Can. Soc. Petrol. Geol., Mem. 5, 859p.
Miall A.D. (1983) : Basin analysis of fluvial sediments. Inc: Modern and ancient fluvial systems; Collinson J.D. and Lewis J. (eds) Int. Assoc. Sedimentol. Spec. Publ. 6, 279-286
Miall A.D. (1984) : Principles of sedimentary analysis. Spring-Vrlag, Berlin,490p.
Potter P.E. and Pettijohn F.J. (1977) : Paleocourents and basin analysis, Springer-Verlag, Berlin, 425p.
Reineck H.E. and Singh I.B. (1980): Depositional sedimentary environments. Spring-Verlag, Berlin, 439p.
Scholle P.A. and Spearing D. (1982) : Sandstone depositional environments. Amer. Ass. Petr. Geol ; mem. 31, 401p.
Vatan A. (1967) : Manuel de sédimentologie. Ed. Technip, Paris, 397p.

Semester 5:

Unit: FEU 521

Heading of subject: Historical Geology

Coeff. 2 Credit. 4

Lecture: 03h00

Teaching Objectives

The objective of this course is to know the main stratigraphic, paleogeographic, and tectonic events that have marked the Earth's past, with special references to Algeria.

Recommended Prerequisite Knowledge

The common core curriculum of L2 is sufficient to follow this course.

Subject Content:

Lecture:

First part: The Proterozoic and Paleozoic

CHAPTER 1: PROTEROZOIC

I- Origins of the Earth and Life

II- General Characteristics of the Precambrian

III- The Precambrian in Algeria

CHAPTER 2: PALEOZOIC

I. Generalities

A. Limits of the Paleozoic Era B. The great biological crises

II. Paleogeography of the Globe

Second part: The Mesozoic

GENERAL CHARACTERISTICS OF THE MESOZOIC ERA

I. Generalities

A. Limits of the Mesozoic Era

B. The great biological crises

II. Paleogeography of the Globe

Third part: The Cenozoic and Quaternary

GENERAL CHARACTERISTICS OF THE CENOZOIC, BIOLOGICAL CRISIS, OROGENESIS, AND PALEOGEOGRAPHY OF THE GLOBE

Assessment Method: Exams and continuous assessment

Bibliographical References

AUBOIN J, BROUSSE R LEHMAN, JP-1967. Précis de Géologie II, Paléontologie-Stratigraphie- Paris Dunod

POMEROL C. (1980).- Stratigraphie et paléogéographie : Ere Paléozoïque.. DOIN Edit. Paris.

POMEROL C. (1977).- Stratigraphie et paléogéographie : Ere Mésozoïque.. DOIN Edit. Paris

Semester 5:

Unit: FEU 522

Heading of subject: Regional Geology (Algerian)

Coefficient: 3 Credit: 5

Lecture: 03h00

Teaching objectives:

The objective of this course is to understand the main stratigraphic, paleogeographic, and tectonic events that have marked the history of the Earth, with special references to Algeria.

Recommended prerequisites:

The L2 core curriculum is sufficient to follow this course.

Course content:

- The main features of Algerian geology
- The geology of the Sahara (Precambrian and Paleozoic):
- The West African Craton (Reguibat Ridge)
- The Pan-African orogeny and the birth of the Targui Shield (Hoggar)
- The major sedimentary cycles of the folded Paleozoic basins of the Sahara.
- The Hercynian phase
- The Saharan platform (Secondary - Tertiary).
- The Late Eocene orogenic phase (Atlas phase)
- The period of relaxation Oligocene - Lower Miocene: the birth of the Numidian Basin.
- The Lower Miocene orogenic phase (Alpine phase): The Maghrebian chain
- The internal zones
- The flysch domain
- The external zones (nappe domain)
- The para-autochthonous foreland
- Post-nappe tectonics and the birth of the current relief.

Assessment method:

Exams and continuous assessment

Bibliographical references

- **Bouillin, J.P., 1986.** Le “bassin maghrébin”: une ancienne limite entre l’Europe et l’Afrique à l’Ouest des Alpes. Bulletin de la Société Géologique de France 8, 547–558.
- **Chouabbi A. 1987.** Etude géologique de la région de Hammam N’bails (SE de Guelma, Constantinois, Algérie) un secteur des zones externes de la chaîne des Maghrébides, Thèse de 3ème Cycle. Univ. Paul Sabatier (Toulouse III), 123 p., carte h.t. inédit, Toulouse.
- **David L. 1956.** Etude géologique des Monts de la haute Medjerda. Thèse sc. Paris. Publication du Service de la carte géologique, Algérie, N.S., Bull. n° 11, 289 p., 88 fig., 8 pl., 6 pl. photo, 9 Pl. h.t., 1 carte, Alger.

- **Durand Delga (1980) :** La méditerranée occidentale et de sa genèse et problèmes structuraux liés à celle-ci. Mem. Soc. Geol.Fr n°10.
- **Durand-Delga, M., Fontboté, J.M., 1980.** Le cadre structural de la Méditerranée occidentale. In: XXVIèCong. géol. Int., Colloque C5:
  Géologie des chaînes alpines issues de la Téthys. Mémoire du Bureau de Recherche Géologique et Minière, Paris, vol. 115, pp. 65– 85.
- **Frison de Lamotte D., Saint Bezar B., Bracene R., 2000.** The two main steps of the Atlas building and geodynamics of the western Mediterranean. Tectonics 19(4), 740-761.
- **Frison de Lamotte D., Michard A., Saddiqi O. 2006.** Quelques développements récents sur la géodynamique du Maghréb. C. R. Géosciences 338 1-10.
- **Frizon de Lamotte, D., Leturmy, P., Missenard, Y., Khomsi, S., Ruiz, G., Saddiqi, O., Guillocheau, F., Michard, A., 2009.** Mesozoic and Cenozoic vertical movements in the Atlas system (Algeria, Morocco, Tunisia): an overview. Tectonophysics 475, 9– 28.
- **Jolivet L., Fraccenna, 2000.** Mediterranean extension and the Africa-Eurasia collision, Tectonics 19. 1095-1106.
- **Laffitte R. (1939).** Etude géologique de l'Aurès, Bull. Serv.
  Carte Géol. Algérie, 1°série, n°11, 484p.
- **Lahondere J.-C. 1987.** Les séries ultra telliennes d'Algérie nord - orientale et les formations environnantes dans leur cadre structural.
  Thèse sc. 242 p. Université Paul Sabatier Toulouse.
- **Perthuisot, V., 1978.** Dynamique et pétrogenèse des extrusions triasiques en Tunisie septentrionale. Thèse ès Sciences, Ecole Normale Supérieure, ERA, pp. 604–610.
- **Rosenbaum, G., Lister, G.S., Duboz, C., 2002.** Reconstruction of the tectonic evolution of the western Mediterranean since the Oligocene.J. Virt. Expl. 8, 107–126.
- **Rouvier H. 1977.** Géologie de l'Extrême-Nord tunisien : tectoniques et paléogéographie superposées à l'extrémité orientale de la chaîne nord, maghrébine, Thèse d'État, université Paris-VI, 1977, 898 p.
- **Thomas M.F.H, Bodin S., Redfern J., Irving D.H.B. 2010.** A constrained African craton source for the Cenozoic NumidianFlysch: Implcations for the palaeogeography of the western Mediterranean basin. Earth-Science Reviews 101 1-23.
- **Vila J.-M. 1980.** La chaîne alpine d'Algérie orientale et des confins algéro-tunisiens. Thèse Sc. Paris, 3 t. 665 p., 199 fig., 40 pl.
- **Wildi, W., 1983.** La chaîne tello-rifaine (Algérie, Maroc, Tunisie): Structure, stratigraphie et évolution du Trias au Miocène. Revue de Géologie dynamique et de Géographie physique. Paris 24 (3), 201– 297.
- **Guiraud R., Bellion Y., Benkhelil J. et Moreau C. (1987) :**
  Post-Hercynian tectonics in Northern an Western Africa. In: BOWDEN P. and KINNAIRD J. (eds) African Geology
  Reviews. Geological Journal, 22, 433-466.

Semester 5:

Unit: MEU 531

Heading of subject: Geophysics

Coeff. 2 Credit. 4

Lecture: 01h30 Tutorials : 1h30

Teaching objectives:

The objective of this course is to master the methods of geophysical prospecting.

Recommended prerequisites:

The core curriculum of S5 is sufficient to follow this course.

Course content:

Chapter 1: Electrical methods

I. GENERALITIES ON ELECTRICAL PROSPECTING

II. BASIC PRINCIPLES IN DC ELECTRICAL PROSPECTING: FUNDAMENTAL EQUATIONS

III. CALCULATION OF ELECTRICAL POTENTIAL

IV. Direct current resistivity methods

IV.1. Vertical electrical sounding

IV.2. Electrical profiling

IV.3. Electrical imaging

Chapter 2: Gravity

Relationship between density and volumetric mass (rock physics course) I. Gravity field and gravitational field

Measurement of the gravitational field

II. Gravimetric corrections and Bouguer anomaly

III. Airy's isostasy theory

IV. Fields created by geometric structures

Chapter 3: Seismic prospecting methods

Chapter 4: Geomagnetism

Assessment method: Exam and continuous assessment

References :

KELLER, G.V., FRISCHKNECHT, F.C. Electrical Methods in Geophysical Prospecting, Pergamon Press, 1966.

-Mechler.P : Les méthodes de la géophysique. Ed Dunod université (1982).

-Seguin, M.K : La Géophysique et les propriétés physiques des roches. Ed : presses de l'université, Laval- Québec (1971).

-Telford W.M : La prospection géophysique (4 tomes).1982 ERG éditions France.

Semester 5:

Unit: MEU532

Heading of subject: Geostatistics

Coefficient: 2 Credit: 4

Lecture: 01h30 Tutorials: 1h30

Objective of the course:

The objective of this course is to introduce the student to applied statistics in geosciences.

Recommended prerequisites:

The common core courses in L1 and L2 are sufficient to follow this course.

Content of the course:

Review of linear statistics (univariate and bivariate)

Distribution parameters

Position parameters

Spatial interpolation methods

Barycentric methods

Triangulation method

Space partitioning interpolation methods

Geostatistical estimation methods

Regionalized variables

Definition of moments

Second-order stationarity

The intrinsic hypothesis

Variogram

Variogram characteristics

Variogram computation

Isotropy and anisotropy

Nested structures

Theoretical variogram models

Adjustment of the experimental variogram

Estimation variance

Development of an estimator

Estimation of a mean by another mean

Estimation of a mean by a weighted mean

Kriging

Ordinary kriging geostatistical procedure

Properties of ordinary kriging

Mathematical expression of ordinary kriging

Universal kriging

Cokriging

Tutorial: Exercises on some calculation methods covered in the lecture

Assessment: Exam and continuous assessment.

Semester 5:

Unit: TEU511

Heading of subject: Technical English

Coefficient: 1 Credit: 1

Course: 01h30

Objectives of the course:

The objective of this course is to enable students to learn the English language so that they can read and consult literature in English.

Recommended prerequisite knowledge:

Having followed the teachings of the first and second year of the Geology Bachelor's degree.

Course content :

Introduction: Why learn English

Grammar: a quick review: tenses, model verbs, conditional... etc.

Reading geology texts: the universe, the earth, rocks, fossils, energy, water

Writing skills: writing essays about different geological subjects. i.e. mineral resources, sedimentary rocks, hydrogeology... etc.

Listening and note-taking: attending a lecture or listening to a recorded conference or a conversation and taking notes.

Assessment method:

Continuous assessment and exam

References :

Murphy Raymond 2004, English Grammar in Use Cambridge University Press.

-Michael McCarthy, Felicity O'Dell 2008, Academic vocabulary in use. Cambridge

University Press 2008

-Yates C. St. 1988, English for academic purposes series: Earth Sciences, Cassell

-Sites internet

Semester 6

Semester 6:

Course: FEU611

Heading of subject: Mineral and Energy Resources

Coefficient: 2 Credit: 4

Lecture: 1h30 Lab: 1h30

Teaching Objectives: To understand the phenomena behind mineral concentrations, to identify and search for them.

Recommended Prerequisites: Geology courses from previous semesters.

Course Content:

- Definitions of ore geology, mining geology, and metallogeny; Ore, texture, paragenesis;
- Veins, ore bodies, concordant and discordant layers;
- Syngenetic and epigenetic mineralization;
- Basic concepts of ore geology, metal deposits, and useful minerals and industrial minerals:
- Metallogenic provinces
- Classification of metal deposits
- Major genetic processes and types of magmatic, metamorphic, hydrothermal, and sedimentary deposits.

Lab:

1 - Review of major petrographic groups: igneous, metamorphic, and sedimentary rocks.

2 - Macroscopic mineralization textures and structures.

3 - Identification of some metallic and non-metallic ore groups under a microscope.

Assessment method: Exams and continuous assessment

References:

Arndt, N.T., Ganino, C.: Mineral resources, origin, nature, and exploitation, Dunod, 2010.

Beaudoin, Georges, 2006. Course manual "Ore Geology and Metallogeny," University of Quebec

Chaussier, J.B.: Mining prospector manual, BRGM Manuals and Methods, No. 2, 1985.

Landry, B.: Mining prospecting, Ed Modulo, Canada.

Routhier, P.: Metal deposits, Ed Masson 1963.

Smirnov, V.: Geology of useful minerals. Ed Mir-Moscow 1988.

Semester 6:

Course: FEU612

Heading of subject: Engineering Geology (Geotechnics)

Coefficient: 2 Credit: 4

Lecture: 1h30 Lab practices: 1h30

Teaching Objectives: To understand the phenomena behind mineral concentrations, to identify and search for them.

Recommended Prerequisites: Geology courses from previous semesters.

Course Content:

Chapter I: Physical properties of soils:

1 - Definition of soils - constituent elements of soil;

2 - Physical characteristics of soils;

Chapter II: Groundwater hydraulics:

1 - Elements of groundwater hydraulics;

Chapter III: Constraints in the soil

1- Notion of constraints

2- Stress-strain

Chapter IV: Principles of geotechnical survey

Overview of geotechnical survey

1- Introduction

2- Objective of the survey

2.1- Different stages of a survey campaign

Chapter V: Survey methods:

1- Wells,

2- Trenches,

3- Augers,

4- Core drilling

5- Sampling and conservation of samples (intact and reworked)

Lab:

1.- Classification of rocks and soils

2.- Visual identification of soils and rocks

3.- Reworked samples

4.- Core boxes

5.- Moisture content measurement

6- Density measurement of soils and rocks

8- Granulometric analysis with densitometer

9- Liquid limit and Plastic limit

10- USCS and GTR soil classification

11- Permeability measurement

12- Geotechnical tests

Assessment method: Exam and continuous assessment

References:

-Philipponnat G. et Hubert B. (2002) : Fondation et ouvrages en terre -Costet J. et Sanglerat G. (1969). Cours pratique de mécanique des sols », Tomes I et II, éditions Dunod.
-Filiat G (1981) : « La pratique des sols et fondations » Editions du Moniteur, Paris
-Schlosser F., 1997. Eléments de mécanique des sols. Presses de L'école Nationale Des Ponts et Chaussées. 269 pages.
-Terzaghi K. etPeck R. B., 1996. Soil Mechanics in Engineering Practice, Hoboken, John Wiley & Sons, 3e éd., 549 pages.
-Wilun Z. and Starzewski K., 1972. Soil mechanics in foundation engineering: properties of soils and site investigations, Volume 1, Surrey University Press. 249 pages.
-LambeT. W. &WhitmanR. V. , 1969. Soil Mechanics.John Wiley & Sons, 576 pages.
-Budhu M. 2011, Soil mechanics and foundations.Third Edition, John Wiley & Sons, 761 pages.

-M.Cassan : Les essais in situ en Mécanique des sols, Edition Eyrolles, 1988,

-Georges Filliat : La pratique des sols et fondations Edition Moniteur(1981),

-P. Antoine et J. Fabre : Géologie appliquée au Génie Civil, Edition Masson, 1980.

-Simons N., Menzies B. and Mathews M. , 2002. A short course in Geotechnical Site Investigation. Thomas Telford, pp 369.
-Clayton C. R. I., Matthews M. C. and Simons N. E., Site Investigation. Department of Civil Engineering, University of Surrey, second edition, Pages 451.

-Antoine P. et Fabre D. 1980. Géologie Appliquée au Génie Civil. Masson, 291 Pages.

-Bouafia A. 2004 : Les essais *in-situ* dans les projets de fondations. Office des Publications Universitaires. 229 pages.

-Costet J. et Sanglerat G. (1969) : « cours pratique de mécanique des sols », Tomes I et II, éditions Dunod

Filliat G. 1981. La pratique des sols et fondations Edition Moniteur

Smith M. R. and CollisL. 1993. Aggregates: sand, gravel and crushed rock aggregates for construction purposes. Geological society
Engineering Geology Special Publication N° 9, 2nd edition, 339 pages.

Semester 6: Unit: FEU621

Heading of subject: Hydrogeology

Coeff. 2 Credit: 4

Lecture: 01:30 Lab practices: 1:30

Teaching Objective:

The objective of this course is to acquire basic concepts in hydrogeology, namely: the notion of hydrological and hydrogeological balance, definition of aquifers, concepts of hydrodynamics, reserves, etc.

Recommended Prerequisites:

The common core courses and S5 are sufficient to follow this course.

Course Content:

Water cycle and hydrological balance

Aquifers

2.1. Notion of aquifer

2.4. Hydrodynamic characteristics of aquifers

Flow laws

3.1. Darcy's law, state equation, storage, diffusivity equation

3.2. Piezometry

Prospecting tools

4.1. Recognition drilling

4.2. Electrical prospecting and logging

Pollution

5.1. Sources and types of pollution

5.2. Vulnerability of groundwater tables

Lab Work:

1- Delimitation and morphometric characterization of a watershed

1- Grain size analysis

2- Permeability determination

3- Hydrogeological mapping-piezometry

4- Reserve calculation

Assessment Method : Exams and continuous assessment

References:

Castany G. (1998). Hydrogeology: principles and methods. Dunod, 236 pages

Gilli E., Mangan C., Mudry J. (2012). Hydrogeology - Objects, methods, applications: Objects, methods, applications. Dunod, 352 pages

Semester 6: Unit: MEU622

Heading of subject: Environmental Geology

Coeff. 4 Credit: 8

Lecture: 01:30 Lab practices: 01:30

Teaching Objective:

The objective of this course is to acquire basic concepts in environmental geology to better prevent the risks of disasters.

Recommended Prerequisites:

The common core courses and S5 are sufficient to follow this course.

Course Content:

I- Study of the relationships between humans and geological phenomena in the environment.

II- Analysis of geological factors in land use.

III- Natural risks of geological nature: earthquakes, landslides, devastating floods, etc.

IV- Mineral and energy resources extracted from the substratum and the consequences of extraction.

V- Groundwater circulation in relation to surface water and environmental problems: acid pollution, water resource exploitation.

VI- Geological criteria for selecting sites for storage or burial of hazardous products.

VII- Geological planning in land use.

IX- Geochemical elements in soils derived from rocks: deficiency and toxicity.

Lab Work:

Exercises on the different chapters

Assessment Method:

Exams and continuous assessment

References:

- Carla W Montgomery. Environmental geology. New York, NY : McGraw-Hill Education.

ISBN: 978-0073524115. (2020)

- James W. LaMoreaux. Environmental Geology. Springer US. ISBN: 978-1-4939-8786-3,

(2019)

- Jim Reichard. Environmental Geology. McGraw-Hill Professional; 3 rd edition. ISBN: 978-0078022968. (2017)

- Knödel, Klaus, Lange, Gerhard, Voigt, Hans-Jürgen. Environmental Geology - Handbook of

Field Methods and Case Studies. Springer-Verlag Berlin Heidelberg. ISBN: 978-3-540-

74669-0. (2007)

- Edward A Keller. Introduction to environmental geology, 4 th Edition. Pearson Education,

ISBN: 9780321830432, (2012)

- Duncan D. Foley, Garry D. McKenzie, Russell O. Utgard. Investigations in Environmental

Geology. 3 rd edition. Prentice Hall. ISBN: 9780131420649. (2008)

Semester 6: Unit: MEU611

Heading of subject: Geology of Algeria

Coefficient: 4 Credit: 8

Lecture: 03h00

Teaching objective:

The objective of this course is to understand the main stratigraphic, paleogeographic and tectonic events that have marked the Earth's past with special reference to Algeria and the Maghreb countries.

Recommended prerequisite knowledge:

The common core curriculum of L2 is sufficient to follow this course.

Course content :

I- Overview of the main features of Algerian geology II - Algeria in the

context of the western Mediterranean.

III - Geology of the Maghreb countries (synthesis).

Practical work:

Sections and comments on geological maps

References :

Bouillin, J.P., 1986. Le "bassin maghrébin": une ancienne limite entre l'Europe et l'Afrique à l'Ouest des Alpes. Bulletin de la Société Géologique de France 8, 547–558.

- **Chouabbi A. 1987.** Etude géologique de la région de Hammam N'bails (SE de Guelma, Constantinois, Algérie) un secteur des zones externes de la chaîne des Maghrébides, Thèse de 3ème Cycle. Univ. Paul Sabatier (Toulouse III), 123 p., carte h.t. inédit, Toulouse.
- **David L. 1956.** Etude géologique des Monts de la haute Medjerda. Thèse sc. Paris. Publication du Service de la carte géologique, Algérie, N.S., Bull. n° 11, 289 p., 88 fig., 8 pl., 6 pl. photo, 9 Pl. h.t., 1 carte, Alger.
- **Durand Delga (1980) :** La méditerranée occidentale et de sa genèse et problèmes structuraux liés à celle-ci. Mem. Soc. Geol.Fr n°10.
- **Durand-Delga, M., Fontboté, J.M., 1980.** Le cadre structural de la Méditerranée occidentale. In: XXVIèCong. géol. Int., Colloque C5: Géologie des chaînes alpines issues de la Téthys. Mémoire du Bureau de Recherche Géologique et Minière, Paris, vol. 115, pp. 65– 85.
- **Frison de Lamotte D., Saint Bezar B., Bracene R., 2000.** The two main steps of the Atlas building and geodynamics of the western Mediterranean. Tectonics 19(4), 740-761.
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- **Jolivet L., Fraccenna, 2000.** Mediterranean extension and the Africa-Eurasia collision, Tectonics 19. 1095-1106.
- **Laffitte R. (1939).** Etude géologique de l'Aurès, Bull. Serv.
Carte Géol. Algérie, 1°série, n°11, 484p.
- **Lahondere J.-C. 1987.** Les séries ultra telliennes d'Algérie nord - orientale et les formations environnantes dans leur cadre structural. Thèse sc. 242 p. Université Paul Sabatier Toulouse.
- **Lepretre et al 2018 .** The tel-rif orogenic system morroco , algeria tunisia and the structural heritage of the tethys of margin. BSGF, 189-2
- **Perthuisot, V., 1978.** Dynamique et pétrogenèse des extrusions triasiques en Tunisie septentrionale. Thèse ès Sciences, Ecole Normale Supérieure, ERA, pp. 604–610.
- **Rosenbaum, G., Lister, G.S., Duboz, C., 2002.** Reconstruction of the tectonic evolution of the western Mediterranean since the Oligocene.J. Virt. Expl. 8, 107–126.
- **Rouvier H. 1977.** Géologie de l'Extrême-Nord tunisien : tectoniques et paléogéographie superposées à l'extrémité orientale de la chaîne nord, maghrébine, Thèse d'État, université Paris-VI, 1977, 898 p.
- **Thomas M.F.H, Bodin S., Redfern J., Irving D.H.B. 2010.** A constrained African craton source for the Cenozoic NumidianFlysch: Implcations for the palaeogeography of the western Mediterranean basin. Earth-Science Reviews 101 1-23.
- **Vila J.-M. 1980.** La chaîne alpine d'Algérie orientale et des confins algéro-tunisiens. Thèse Sc. Paris, 3 t. 665 p., 199 fig., 40 pl.
- **Wildi, W., 1983.** La chaîne tello-rifaine (Algérie, Maroc, Tunisie): Structure, stratigraphie et évolution du Trias au Miocène. Revue de Géologie dynamique et de Géographie physique. Paris 24 (3), 201– 297.
- **Guiraud R., Bellion Y., Benkhelil J. et Moreau C. (1987) :** Post-Hercynian tectonics in Northern anWestern Africa. In:
BOWDEN P. and KINNAIRD J. (eds) African Geology
Reviews. Geological Journal, 22, 433-466.
- **lil J. et Moreau C. (1987) :** Post-Hercynian tectonics in Northern anWestern Africa. In: BOWDEN P. and KINNAIRD J. (eds) African Geology Reviews. Geological Journal, 22, 433466.

Semester 6:

Course Code: MEU612

Heading of subjet : Field Internship

Coefficient: 2 Credit: 4

Course Objectives

Field trips allow for the illustration and better understanding of some geological phenomena developed in various fundamental and applied subjects of Geology. They constitute an important part of the training of undergraduate students in Geology.

Recommended Prerequisites

It is necessary to have completed the various courses of Semester 5 and a large part of the program of Semester 6 in order to consider trips in each of the fields of Applied Geology.

Course Content

The themes of these 6 to 8-day field trips are varied.

They cover both Applied Geology and the different subjects taught in optional units.

Assessment Method

Evaluation of the reports of the various field trips.

Semester 6:
Course Code: TEU611
Heading of subject: Ethics and Deontology
Coefficient: 1 Credit: 1
Duration: 1h30
Course Objectives

To inform and sensitize students about the risk of corruption and encourage them to contribute to the fight against corruption.

Recommended Prerequisites None.

Course Content

1- The concept of corruption:

Definition of corruption.

Religion and corruption.

Types of corruption:

Financial corruption.

Administrative corruption.

Moral corruption.

Political corruption, etc.

2- Manifestations of administrative and financial corruption:

Nepotism

Favoritism

Mediation

Extortion and fraud.

The embezzlement of public funds and illegal expenses.

The slowing down of transactions (completion of projects, etc.).

Administrative, functional, or organizational discrepancies of the employee and the supervisor.

Violations committed by the civil servant in the course of the year.

Lack of respect for working hours, reading newspapers, receiving visitors, and abstaining from work and responsibility.

4- Reasons for administrative and financial corruption:

4.1 Reasons for corruption from the point of view of theorists:

Theorists and researchers in the science of management and organizational behavior have identified three categories of reasons for corruption, which are:

According to the first category:

- Civilizational reasons.

- For political reasons.

According to the second category:

- Structural reasons.

- Value judgments reasons.

- Economic reasons.

According to the third category:

- Biological and physiological reasons.

- Social reasons.

- Complex reasons.

4.2 General causes of corruption:

Weak institutions, conflicts of interest, the rapid search for profit and gains, weak awareness of the role of educational institutions and the media, and non-compliance with the law, etc.

5- The effects of administrative and financial corruption:

The impact of administrative and financial corruption on social aspects

The impact of financial and administrative corruption on economic development

The impact of administrative and financial corruption on the political system and stability.

Fighting corruption by local and international organizations and agencies:

6- Transparency International Organization:

United Nations Convention against Administrative Corruption.

World Bank program to assist developing countries in the fight against administrative corruption.

International Monetary Fund.

Efforts by Algeria against corruption: anti-corruption law 06-01, the role of the judicial police in the fight against corruption, etc.

Methods of dealing with and ways to combat corruption:

Religious, educational, political, economic, legislative, judicial, administrative, human sides, etc.

7- Models of the experience of some countries in the fight against corruption:

Indian experience, Singapore experience, U.S. experience, Hong Kong experience, Malaysia experience, and Turkey experience.

Assessment Method : Exam

Semester 6:

Unit: TEU612

Heading of subject: Project Management

Coefficient: 1 Credit: 1

Lecture: 01h30

Teaching Objectives:

The objective of this course is to initiate students into research by showing them how to make the best use of and highlight the theoretical and practical knowledge they have acquired throughout their academic journey.

Recommended prior knowledge:

Course content

- Field methods (Mapping, Facies, Sampling, ...);
- Laboratory (Appropriate analyses for each type of problem to be studied);
- Data analysis;
- Report writing;
- Translation of geological articles;
- Bibliographic research methods;

Assessment method: Continuous assessment, EMD

References:

(Books and lecture notes, websites, etc.)