

**COURSE DATA****Data Subject**

<b>Code</b>	33079
<b>Name</b>	Geology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2021 - 2022

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1104 - Degree in Environmental Sciences	Faculty of Biological Sciences	1	Second term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1104 - Degree in Environmental Sciences	117 - Geology	Basic Training

**Coordination**

<b>Name</b>	<b>Department</b>
BASTIDA CUAIRAN, JOAQUIN	200 - Geology
SANTISTEBAN BOVE, CARLOS DE	200 - Geology

**SUMMARY**

The subject of Geology is part of the Environmental Degree, and has a direct and first grade relation with environmental issues as a natural science that it is. The subject will be explained and understood as a description of physical and chemical processes induced energy changes that result in the development of geological processes. In this sense, the subject arises with the introduction of some basic issues in the context of Geological Sciences, to continue with the endogenous geological processes of great importance in the structure and composition of the Earth's crust and in particular to continue with the genesis of the exogenous geological processes that more significant by the fact take place on the earth's surface and they have a greater role in the environment. Setting the connecting links and interrelationships between endogenous and exogenous processes and without which many problems of geology not be explained.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

## COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

### 1104 - Degree in Environmental Sciences

- Comprender los conceptos, principios, procesos y teorías geológicas generales.
- Capacidad para identificar y valorar las características geológicas del medio físico y la descripción de materiales geológicos.
- Capacidad de evaluar, interpretar y sintetizar información geológica sobre el terreno y sobre mapas geológicos y otros métodos de representación.

## LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

To know the structure of The Earth and the principles and evidences on wich is based the structural model of our planet.

To know that the Earth is in permanent evolution on the basis of an internal energy (heat and gravity) that is in the origin of the internal processes and another that is the cause of the external geological processes.

To understand the concept of "geological time " and the location in the space and time of the main events of the evolution of the Earth.

To be able to identify the rocks and the rock bodies that they present in the lithosphere.

To understand the representation of the main geological features (lithology, structures and ages), by means of the reading and analysis of geological maps.

To understand how the internal and external geological processes are the source of the diversity of environments and environmental systems that support the life, and the reason of the fisiographic features of our landscapes.

To learn to value the elements of the geodiversity as part of the natural diversity and to estimate the geological heritage.

To know the basic features of the regional geology of the Valencian Community.



## DESCRIPTION OF CONTENTS

### 1. GENERAL CONCEPTS

1. THE GEOLOGICAL SCIENCES. Definition and aims. Historical stages in the development of the Geology. The scientific method in Geology. Description, prediction and retrodiccion. Structure of the Geological Sciences. Relation of the Geology with other sciences. Environmental geology and the Environmental Sciences in relation with the Geology.

2. THE EARTH AS A PLANET. The Earth in the Solar System. The Moon. Astronomical parameters of The Earth. Origin and primitive evolution of The Earth. Shape and dimensions.

3. PHYSICAL CHARACTERISTICS OF THE EARTH. Mass and density. Gravitational field. Elipsoid, spheroid and Geoid. Isostasy. Heat and radioactivity. Thermal flow and convection. The magnetic field of The Earth. Magnetic declination and inclination. Changes of polarity. Magnetosphere. Paleomagnetism.

4. THE INTERIOR STRUCTURE OF THE EARTH. Seismology. Types of seismic waves. Reflection and refraction. Variation of wave velocities. The interior structure in layers: Crust, Mantle, and Core. Continental and oceanic crust. Composition and horizontal and vertical structure of The Earths Crust. Seismic and dynamic structure of the Mantle. Mantle hot plumes and Hot Spots. The Layer "D" or of megaliths. The external and internal Core. Comparative Information of the meteorites. Minerals: structure and properties. Rock-forming minerals.

### 2. INTERNAL GEODYNAMICS

5. CRUSTAL PROCESSES: I CRUSTAL DYNAMICS. Paleomagnetism in the oceanic crust and expansion of the oceanic crust. Tectonic Plates. Dynamics in the limits of plates. Plate motions and stress regimes. Oceanic ridges. Foldbelts. Volcanic arcs. Oceanic trenches. Fracture zones. Linear volcanic island chains. Cratons and tectonostratigraphic terranes. Fracturing of cratons. Triple junctions. Wilson's Cycle. The system of Western europe grabens. Saline giants.

6. CRUSTAL PROCESSES: II - STRUCTURAL GEOLOGY. Tectonic deformation. Types of tectonic deformation: folds and fractures. Elements of a fold. Types of folds. Mechanics of the folding, structures associated with the folds. Ductile deformation in conditions of metamorphism. No tectonic folds. Nechanics of the fracturation. Faults and joints. Elements of the faults. Fault slip. Types of faults. Graben, thrust faults and nappes. Saline Diapirs.

7. CRUSTAL PROCESSES: III - MAGMATISM. Definition. What is a magma? Volcanism and plutonism. Intrusive and extrusive rocks. Textures and structures of the igneous rocks. Bodies of igneous rocks. Chemical classification of the igneous rocks. Lava flows. Pyroclastic deposits.

8. CRUSTAL PROCESSES: IV - METAMORPHISM. Definition. Factors of the metamorphism. Metamorphic processes. Grade of metamorphism. Metamorphic minerals. Types of metamorphism. Metamorphic textures: slate fabric, cleavage and schistosity, gneiss, cataclasite, mylonite. Series of regional metamorphism: facies and metamorphic rocks.



### **3. EXTERNAL GEODYNAMICS I**

**9. SURFACE PROCESSES AND ENVIRONMENTS: I WEATHERING AND SOILS.** External Earth processes. Earth-surface environments. Erosion and weathering. Processes of weathering. Products of weathering. Soil-forming factors. Soil profile. Paleosols. Pedocal, pedalfer, laterites i bauxites.

**10 SURFACE PROCESSES AND ENVIRONMENTS: II - SEDIMENTARY ENVIRONMENTS.** Contexts, processes and products. The energy that drives the processes of the Earth-surface geodynamics. Sedimentary basins. Transport mechanisms. Traction, saltación and suspension. Gravitational processes. Types of gravitational processes. Sedimentary load. Processes of sedimentation and types of sediments. Litification and diagenesis. The sedimentary rocks: Clastic, carbonates, evaporites, siliceous, phosphates, iron-aluminium ores, coal and oil. Stratification and lamination. Forms of sedimentary bodies. Sedimentary facies. Sedimentary structures. Sedimentary systems and environments: nonmarine, transitional, marine.

**11 SURFACE PROCESSES AND ENVIRONMENTS : III GLACIAL, FLUVIAL and ALLUVIAL, EOLIAN AND LACUSTRINE ENVIRONMENTS.** Present-day glaciers. Types of glaciers. Glacier flow. Erosion and transport. Glacial sediments. The shape of landscape in glaciated areas. Glacial theory and Quaternary glaciations. Glacier Theory and Quaternary glaciations. Causes of glaciations.

Fluvial and alluvial environments. Definition. Types: colluvium, alluvial fans, braided rivers, meandering systems and anastomosed rivers. Environments and sub-environments. Processes of transport and sedimentation. Sedimentary forms.

Eolian environment. Definition and location. Processes of erosion, transport and sedimentation by wind. Desert pavement. Yardangs. Ripples of adhesion and dunes. Types of dunes. Loess.

Lacustrine environment. Definition and types. Classification of lakes. Property of the waters. Oxygen and nutrients. Temperature and density of lake waters. Water movement. Lacustrine sedimentation.

### **4. EXTERNAL GEODYNAMICS II**

**12 SURFACE PROCESSES AND ENVIRONMENTS: IV - UNDERGROUND WATERS AND THE KARST**

Underground waters. Infiltration. Vadose and phreatic zones. Porosity and permeability. Aquifers. Groundwater flow. Groundwater withdrawal. The groundwaters as resource. Saltwater intrusion. Pollution of underground waters .

The Karst. Karstic landscapes. Endokarst and exokarst. Karst determining factors. Dolina, uvala poljé. Caves. Speleothems. Climate, underground water table and karstic solution. Karst evolution.

**13 SURFACE PROCESSES AND ENVIRONMENTS: V CLASTIC SHORELINES, DELTAS, TIDAL FLATS AND ESTUARIES.** The shape of the coast. Changes of the sea-level. Sea-level Systems tracts. Classification of coasts.

Beaches. Subenvironments of a beach. Seasonal dynamics of a beach. Barrier-islands . The lagoon. Tidal inlets, ebb and flood deltas. Washover fans.

Deltas and fan-deltas. Environments of a delta: delta plain, delta front and prodelta. Types of deltas.

Tidal flats. Supratidal, intertidal and subtidal zones.





Estuaries. Types of estuaries.

14 SURFACE PROCESSES AND ENVIRONMENTS: VI. MARINE ENVIRONMENTS. Holocene coral reefs. Controlling influences for the development reefs on the open sea. Types of reefs. Reefal environments. Coral zonation in a modern reef. Shallow siliciclastic seas. Shelf sedimentation. Submarine canyons. The continental slope. Oceanic canals. Deep-sea fans.

## **5. THE GEOLOGICAL TIME. REGIONAL AND ENVIRONMENTAL GEOLOGY.**

15 GEOLOGICAL TIME. The geological record. Nature of the stratigraphic record. Geological time (physical time, stratigraphical time, historical time). Transgressions and regressions. Walther's Law. Unconformities. Types of unconformities. Geological age-dating. Absolute and relative dating. The time in unconformities. Geochronology and chronostratigraphy. The geologic time chart.

16 REGIONAL GEOLOGY. Geology of Spain. Orogenies: Cadomian, Variscan and Alpine. Alpine fold-belts. Cenozoic basins and volcanic fields. Tectonostratigraphic domains in the Iberian System and in the Betics. Catalánides, Aragonese Branch, Linking Zone, Castilian - Valencian Branch. The Prebetic. Evolution of the Iberian System and the Betics.

17 ENVIRONMENTAL GEOLOGY. Geological hazards. Environmental impact of the mining labors and extraction of hydrocarbons. Waste disposal. Underground storage of compressed air, natural gas and CO<sub>2</sub>. Geological perspective of Climate Change. Geodiversity and geoheritage. Conservation and interpretation of the geodiversity. Geotourism.

## **6. PRACTICES**

1-Macroscopic recognition of igneous, metamorphic and sedimentary rocks, on the basis of its composition, textures and structures

2-The geological map

2a Types of geological maps (lithologic, structural, facies, sedimentary environments, geomorphologic, hydrogeologic, ...etc). Keys: lithology, age and structure.

2b- Geological cross-sections.

Horizontal beds. Contacts, thickness of a unit.

Folds-I: monoclines. Strike and dip.

Folds-II: synform and antiform (syncline and anticline, overturned folds).

Faults: normal faults, overthrusts, nappes.

2c- Stratigraphic unconformities.

2d- The mapping of igneous rocks.

2e- Diapirs.

3- Description of the geological history of a map.

4- Field practice.



## 7. Tutorials

Six offers, to choosing three:

- 1- Program of literacy in Geology
- 2- Plate tectonics. Cratons, foldbelts and terranes.
- 3- Mineral resources
- 4- Igneous rocks bodies. Plutons, dikes and sills.
- 5- Strike-slip faults and shear, pull-apart basins, transcurrence, transformation faults

## WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	36,00	100
Laboratory practices	21,00	100
Tutorials	3,00	100
Attendance at events and external activities	3,00	0
Development of individual work	5,00	0
Study and independent work	37,00	0
Readings supplementary material	10,00	0
Preparing lectures	21,00	0
Preparation of practical classes and problem	14,00	0
<b>TOTAL</b>	<b>150,00</b>	

## TEACHING METHODOLOGY

The knowledge that students must acquire in this course will get them throughout the course by developing various activities, such as:

- Lectures
- Labs
- Field practices
- Video projection
- Reading books
- Tutoring



In case of an unforeseen circumstance that alters the normality established in the teaching process, the lecturers and tutoring will be through the telematic resources enabled by the university authorities (Virtual Classroom, videoconference, e-mail...).

## EVALUATION

The theory:

- The evaluation of the learning will be done by an written exam with questions of reasoning.

(Participation in the final qualification: 70 %)

- A control of presence in the proposed activities will be done. This will be necessarily to overcome the subject.

Practices:

- Exercice of resolution of a geological map. Theoretical and practical final examination, with participation in the final qualification with 20% of the total.

- Examination of rock identification, with participation in the final qualification with 10% of the total.

To approve the subject there has to approve each of his parts (theory, maps, rocks) separately.

In case of an unforeseen circumstance that alters the normality established in the teaching process, the evaluation would be in accordance with the topics of theory taught and the practices carried out.

Proportionality will be maintained in the rating of 7 points (theory) and 3 points (practice). Depending on the circumstances, it is planned to make a continuous evaluation by topics or blocks of topics and bibliographic written Works.

To request the advance of the examination of this subject the student must bear in mind that it will have realized the obligatory activities that are indicated in this guide.

## REFERENCES

### Basic



- Tarbuck, E.J. y Lutgens, F.K. 2013. Ciencias de la Tierra. Una introducción a la Geología Física. Pearson, 848 pp., Madrid.
- Bastida, F. 2005, Geología. Una visión moderna de Las Ciencias de La Tierra. Volumen I, Ediciones Trea, 974 pp. Gijón.
- Bastida, F. 2005, Geología. Una visión moderna de Las Ciencias de La Tierra. Volumen II, Ediciones Trea, 1.031 pp. Gijón.
- Monroe, J.S., Wicander, R. Y Pozo, M. (2008): Geología: Dinámica y evolución de la Tierra. Ed. Paraninfo. 726 pp.
- Orozco, M., Azañón, J.M., Azor, A. y Alonso, F.M. (2002), Geología Física, Paraninfo-Thomson-Learning. Madrid. 302 pp.
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- Montgomery, C. M., 2014, Environmental geology. McGraw-Hill. 500 pp.
- J. A. Vera. (Ed.) 2004, Geología de España, Sociedad geológica de España e IGME, 884 pp. Madrid.
- Santanach, P. et al., 1986, Historia Natural dels Països Catalans. Geologia Vol I, 439 pp. Enciclopedia Catalana.
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- Pozo Rodriguez M., González Yélamos J. y Giner Robles J.L. (2004). Geología Práctica. Pearson Prentice Hall., 352 pp.
- GuerraMerchán, A. 1994. Mapas y cortes geológicos. CEP-Málaga, Junta de Andalucía. 129 pp.

## **ADDENDUM COVID-19**

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

Como norma general, la modalidad de docencia se adaptaría a la situación sanitaria del momento y a lo que las autoridades sanitarias y académicas acuerden en este sentido.

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### **Contents**

In case of the cancellation of teaching in the classroom the contents will be presented by means of telematic enabled for the purpose, or deposit in the virtual classroom of documents and links to the contents of the subject. It is not intended to withdraw the contents of the teaching guide.

### **Volume of work and temporary planning**





The workload for laboratory practices can be achieved in three different forms:

- a) 3-hour hands-on classes per practice for students assigned to classroom capacity.
- b) Hands-on practical classes of 1.5 hours per practice plus exercises to be carried out outside the classroom for a duration of 1.5 hours per practice.
- c) Field practice of 5 hours effective duration per practice.

### **Teaching methodology**

In case of an unforeseen circumstance that alters the normality established in the teaching process, the lecturers and tutoring will be through the telematic resources enabled by the university authorities (Virtual Classroom, videoconference, e-mail...).

### **Evaluation**

In case of an unforeseen circumstance that alters the normality established in the teaching process, the evaluation would be in accordance with the topics of theory taught and the practices carried out.

Proportionality will be maintained in the rating of 7 points (theory) and 3 points (practice). Depending on the circumstances, may be made a continuous evaluation by topics or blocks of topics and bibliographic written Works.