60439 - Climatic changes, associated events and geologic record

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	541 - Master's in Geology: Techniques and Applications
ECTS	5.0
Course	1
Period	Second semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

Past climate changes are reflected in the geological record through diverse lithological, biological and geomorphological attributes. Their study reveals that the causes of climate changes are a complex interaction of intrinsic and extrinsic parameters that affect the Earth system. The analysis of such attributes is of great importance for assessing the response of the Earth system to climate changes and provides information to calibrate predictive models of climate evolution.

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The designed learning process will allow the students to acquire knowledge on the main causes and consequences of climate change events, to understand the interaction among different systems, and to identify and interpret climatic proxies in the geological and biological record.

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The knowledge acquired in the participatory lectures is complemented with practical laboratory activities and field work, where the student will learn and demonstrate methods and analyses, and the results of their application.

5.2.Learning activities

The learning program includes the following activities:

1 Participatory Lectures

2 Laboratory work: Implementation of the working methods in laboratory with appropriate equipment and techniques

3 Field work: Identification of relevant geological characteristics of the study areas and implementation of study and sampling strategies appropriate for identifying characters with paleoclimatic significance

5.3.Program

Part I. Introduction

1. Causes of climate changes.

Part II. Paleoclimatology and facies.

1. Sedimentary facies with climatic significance.

2. Glacial facies. Distribution of glacial deposits through time. Causes of glaciations. Facies models.

3. Desert sandy aeolian facies. Geologic and climatic context. Conservation of sandy deposits. Examples of ancient and modern aeolian systems.

4. Marine and continental evaporitic facies. Geologic and climatic context. Facies associations. Distribution of evaporites through time.

5. Lacustrine and fluvial carbonate facies. Geologic and climatic context. Facies associations and facies models. Examples of ancient and modern carbonate lacustrine and fluvial systems.

6. Coal. Conditions and environments of formation. Conservation. Paleogeographic evolution.

7. Other sedimentary facies with climatic significance.

Part III. Quaternary continental morphosedimentary records with paleoclimatic interest

1. Climatic structure of Quaternary. Climatic cycles and terminations. The Last Glacial Cycle. The Holocene.

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2. Glacial and periglacial records. Quaternary glacial evolution at regional scale. Ice caves as singular archives.

3. Fluvial and alluvial records. Terrace formation and paleoclimatic control. Regional sequence of terraces.

4. Karstic records: tufa and speleothem archives. The karstic system dynamics. Paleoenvironmental significance of isotopic and geochemical proxies. Regional setting.

5. Lacustrine records. Multiproxy approach to the paleoenvironmental meaning. Paleohydrological interpretation. Regional scenery.

Part IV: Climate changes and the paleontological record

1. Fossil fauna and flora and paleoclimatic proxies. Bioclimatic modelling and fossil groups.

2. Evolutionary and extinction events associated with climate changes. Geological record of Paleozoic and Mesozoic events. Climatic and biotic consequences of the Cretaceous/Paleogene boundary asteroid impact.

3. Multiproxy analysis of hyperthermal events: evolution and extinction across the Paleocene-Eocene transition. Consequences of the Antarctic isolation and the albedo effect on the middle-upper Eocene and Eocene/Oligocene extinctions.

4. The sixth mass extinction across the Quaternary. The extinction of the megafauna since 100.000 years ago. Agroecological change and extinction over the last 10.000 years.Global warming and extinction during the Antropocene.

Practical sessions

Part II.

Laboratory (4 h)

1. Analysis and interpretation of sedimentological and paleogeographic data.

2. Analysis and interpretation of geochemical data.

Field work (1 day)

1. Ebro Basin: Evolution of the Miocene lacustrine systems through space and time.

Part III.

Laboratory (4 hours)

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1. Recovering and sampling Quaternary lacustrine archives.

2. Interpretation and treatment of chronological, isotopic and geochemical data from stalagmite records.

Field work (1 day, 4 hours)

1. Recognition and description of Quaternary glacial and fluvial records in the Central Pyrenees (Gállego river valley, Northern Spain). The Penultimate and the Last climate cycles in the Mediterranean Mountains.

Part IV.

Laboratory:

1. Evidence for the asteroid impact at the Cretaceous/Paleogene boundary.

2. Multiproxy analysis and interpretation across the Paleocene-Eocene transition (palaeontology, stable isotope geochemistry of bulk sediment and fossils, organic biomarkers, mineralogical composition, etc.).

5.4.Planning and scheduling

This subject is taught during the second semester, on Monday from 16:00 until 20:00. The dates of fieldwork are scheduled by university.

5.5.Bibliography and recomended resources

- Palaeoclimates and their modelling : with special reference to the Mesozoic era / edited by J.R.L. Allen ... [et al.] . - [1st ed.] London [etc.] : Chapman & Hall [for] The Royal Society, 1994
- Arthur, M.A.. Stable isotopes in sedimentary geology. SEMP short course n. 10. Tulsa (USA). 1983
- Bradley, Raymond S.. Paleoclimatology : reconstructing climates of the quaternary / Raymond S. Bradley . - 2nd ed. San Diego, CA. : Academic Press, 1999
- Cronin, T.M. Principles of paleoclimatology. Columbia University Press. 1999
- Cronin, Thomas M.. Paleoclimates : understanding climate change past and present / Thomas M. Cronin New York : Columbia University Press, cop. 2010
- Crowley, Thomas J.. Paleoclimatology / Thomas J. Crowley, Gerald R. North New York : Oxford University Press ; Oxford : Clarendon Press, 1991
- Einsele, Gerhard. Sedimentary basins : evolution, facies, and sediment budget / Gerhard Einsele . - 2nd, completely rev. and enl. ed Berlin [etc.] : Springer, cop. 2000
- Einsele, G.. Cycles and events in Stratigraphy. Springer-Verlag, Berlín, 1991.
- Frakes, Lawrence A.. Climates throughout geologic time / by L.A. Frakes . - 1st ed., 2nd imp. paperback ed. Amsterdam [etc.] : Elsevier Scientific, 1980
- Frakes, Lawrence A.. Climate modes of the Phanerozoic : the history of the earth's climate over the past 600 million years / Lawrence A. Frakes, Jane E. Francis, Jozef I. Syktus . - 1ª paperback version Cambridge : Cambridge University Press, 2005
- Gornitz, V. . Encyclopedia of Paleoclimatology and ancient environments. Springer. 2009
- Hoefs, Jochen. Stable isotope geochemistry / Jochen Hoefs . - 5th, completly rev. upd. and enlarged ed. Berlín : Springer-Verlag, cop. 2004
- Isotopes in palaeoenvironmental research / edited by Melanie J. Leng Dordrecht, The Netherlands : Springer, cop. 2006
- Leroux, Marcel. Global warming : myth or reality : the erring ways of climatology / Marcel Leroux Berlin : Springer ; Chichester, U.K. : Published in association with Praxis Publishing, cop. 2005

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- Martín Chivelet, Javier. Cambios climáticos : una aproximación al Sistema Tierra / Javier Martín Chivelet [Madrid : Libertarias, 1999]
- Modern and past glacial environments/ editor, John Menzies . - Rev. student ed Oxford : Butterworth-Heinemann, 2002
- Parrish, Judith Totman. Interpreting pre-Quaternary climate from the geologic record / Judith Totman Parrish New York : Columbia University Press, cop. 1998
- Sedimentary environments : Processes, Facies and Stratigraphy / edited by H. G. Reading . - 3rd. ed. New York : Elsevier, 1996
- Reineck, Hans-Erich. Depositional sedimentary environments : with reference to terrigenous clastics / H.-E. Reineck, I.B. Singh . - 2nd ed., rev. and updated Berlin [etc.] : Springer-Verlag, 1980
- Reineck, Hans-Erich. Depositional sedimentary environments : with reference to terrigenous clastics / H.-E. Reineck, I.B. Singh . - 2nd ed., rev. and updated, 2nd print. Berlin [etc.] : Springer-Verlag, 1986
- Techniques in sedimentology / edited by Maurice Tucker . - 1st published Oxford : Blackwell Scientific Publications, 1988
- Tucker, Maurice E.. Carbonate sedimentology / Maurice E. Tucker, V. Paul Wright ; with a chapter by J.A.D. Dickson . - 1st ed., repr. Oxford [etc.] : Blackwell Scientific Publications, 1992
- Tucker, Maurice E.. Carbonate sedimentology / Maurice E. Tucker, V. Paul Wright ; with a chapter by J.A.D. Dickson . - 1st ed., repr. Oxford [etc.] : Blackwell Scientific Publications, 1994
- Flannery, Tim. El clima está en nuestras manos : historia del calentamiento global / Tim Flannery ; traducción de Damián Alou Madrid : Taurus, D. L. 2007
- Deep-time perspectives on climate change : marrying the signal from computer models and biological proxies / edited by M. Williams ... [et al.] London : The Geological Society, 2007
- Gore, Albert. Una verdad incómoda : la crisis planetaria del calentamiento global y cómo afrontarla / Al Gore ; [traducción, Rafael González del Solar] Barcelona : Gedisa, 2007
- Naturaleza aragonesa : Revista de la Sociedad de Amigos del Museo Paleontológico de la Universidad de Zaragoza . Zaragoza : Sociedad de Amigos del Museo Paleontológico de la Universidad de Zaragoza, 1997- [Publicación periódica] [Molina, E. y Lorente, J.M. 2000. Causas e incidencias de la última extinción en masa en Aragón. Naturaleza Aragonesa, 6, 20-25.]