

<b>COURSE: Environmental Geochemistry</b>			
ACADEMIC YEAR: <b>2016-2017</b>			
TYPE OF EDUCATIONAL ACTIVITY: <b>Basic</b>			
TEACHER: <b>Dott. Michele Paternoster</b>			
e-mail: <b>michele.paternoster@unibas.it</b>		website:	
phone: <b>0971-205832</b>		mobile (optional): <b>3477281398</b>	
Language: <b>English</b>			
ECTS: 6 (4 of lesson and 2 of tutorials/practice)	n. of hours: 56 (32 of lesson and 24 of tutorials/practice)	Campus: Potenza Dept./School: Department of Sciences Program: MASTER COURSE IN GEOSCIENCES AND GEORESOURCES	Semester: II (planned dates: 09/03/2017 start; 15/06/2017 end)

**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

The main goal of this course is to provide the know-how useful for studying the geochemical processes occurring in the surface environment. Major achievements: sampling, validation of the geochemical data, and conceptual models. Description of a geochemical system and evaluation of the effect of the anthropogenic and geogenic contributions.

The principal knowledge:

- Natural abundance of the elements;
- Basic principles of geochemical prospecting
- Water geochemistry and hydrologic cycle
- Sedimentary geochemistry;
- Using stable isotopes for environmental issues

The expected learning outcomes:

- The comprehension of the concepts relating to geochemical baselines and anomalies (natural and/or anthropogenic), and the factors constraining the element mobility in the surface environment;
- To understand the main analytical and sampling techniques of different environmental matrices;
- To study the geochemical composition of natural waters and sediments, their analysis and classification;
- To use geochemistry for the solving of problems concerning to: I) surface water and groundwater pollutions; II) sediment pollution;
- Analysis of isotopic tracers in order to understand: I) the water-rock interaction processes; II) the hydrogeology and environmental problems; III) the origin and provenance of waters.

**PRE-REQUIREMENTS**

Basic knowledge of chemistry (elements, atoms, ions, bonding and reactions, periodic table, acid-base equilibria) and geochemistry (Energy, Entropy and Fundamental Thermodynamic Concepts, geochemical system, units of measurements)

**SYLLABUS**

- General aspects: Natural abundance of the elements, Geochemical classification of the elements (4 hours).
- Basic principles of geochemical prospecting: geochemical environment; dispersion patterns, geochemical mobility under conditions of low pressure and temperature; geochemical associations, distribution patterns. Definition of background, anomaly, and threshold value), (6 hours).
- Geochemical prospecting for environmental issues:  
*Water*: Main sampling and analytical methods. Determination of the physico-chemical parameters in situ; graphical representation and data processing. Evaluation of laboratory data (sampling and analytical errors, accuracy and precision), (8 hours + 12 hours of lab activities).  
*Sediment*: definition of sediment, weathering of rocks and minerals, clay minerals; sampling: points, materials and methods, samples storage; granulometric, mineralogical and chemical analysis: preparation and instruments; graphical representation and data processing, (8 hours + 10 hours of lab activities).

- Stable isotope geochemistry for environmental issues: General features of isotopes (definitions, terminology, analysis, standards). Isotope fractionation; applications of the stable isotopes ( $\delta D$  and  $\delta^{18}O$ ) in hydrology; application of stable isotopes (carbon, sulfur, and nitrogen) in environmental issues, (6 hours + 2 hours of lab activities).
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#### TEACHING METHODS

Teacher intended 32 hours to theoretical lessons and 24 hours to classroom and laboratory tutorials. Field trips are also planned. Field and laboratory activities are mandatory.

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#### EVALUATION METHODS

During the course three intermediate verifications are planned. Any verification test will consist of 5 open-ended questions at which a score between 0 and 6 will be assigned. Grades will be based on performance of the students in the three intermediate verifications

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

##### Textbook:

- Principles of Environmental Geochemistry. G. Nelson Eby. Thomson-Brooks/Cole, 2004.

##### Suggested books:

- Geochemistry, Groundwater and Pollution (2<sup>nd</sup> Edition). Appelo, C.A.J.; Postma, Dieke. AA Balkema Publishers, Netherlands, 2005.
- Environmental and low temperature geochemistry. Peter Ryan. Wiley Blackwell, 2014.
- Principles of Isotope Geology (2<sup>nd</sup> Edition). Gunter Faure. John Wiley & Sons, New York, 1986.
- Using Geochemical Data: Evaluation, Presentation, Interpretation. Hugh R. Rollinson. Harlow, Essex, England : New York : Longman Scientific & Technical ; Copublished in the U.S. with J. Wiley & Sons, 1993.

Lecture notes and learning resources provided by the teacher during the course.

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#### INTERACTION WITH STUDENTS

Lecturer will receive students in his office (on the second floor of the building 3D, room no. 205) on Mondays and Wednesdays from 12:00 to 14:00. The appointment must be agreed by email ([michele.paternoster@unibas.it](mailto:michele.paternoster@unibas.it)).

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#### EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

04/07/2017; 27/07/2017; 28/09/2017; 24/10/2017; 28/11/2017; 20/12/2017; 20/02/2018

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SEMINARS BY EXTERNAL EXPERTS    YES     NO

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#### FURTHER INFORMATION

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<sup>1</sup>Subject to possible changes: check the web site of the Teacher or the Department/School for updates.