
COURSE: Environmental Geochemistry

ACADEMIC YEAR: 2019-2020

TYPE OF EDUCATIONAL ACTIVITY: Basic

TEACHER: Michele Paternoster

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Language: **English**

ECTS: **6** (4 of lesson and
2 of tutorials/practice)n. of hours: **56** (32 of lesson
and 24 of tutorials/practice)Campus: Potenza
Department of Sciences
Program: MASTER COURSE IN
GEOSCIENCES AND GEORESOURCESSemester: **II**
(planned dates:
02/03/2020 start;
20/06/2020 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, analytical methodologies, validation of the geochemical data, and definition of conceptual models. Description of a geochemical system and evaluation of the effect of the anthropogenic and geogenic contributions.

• Knowledge and ability to understand:

The student must demonstrate to know the environmental problems that may concern natural matrices. In addition, through the definition of a conceptual geochemical model, the student must understand the behavior of the chemical elements, their mobility and the possible contribution of pollutants that may have both natural and anthropic origins.

• Ability to apply knowledge and understanding:

The student must be able to:

- Understand the concepts relating to geochemical baselines and anomalies (natural and/or anthropogenic), and the factors constraining the element mobility in the surface environment;
- know and apply the main analytical and sampling techniques of different environmental matrices;
- Utilize the knowledge on geochemical composition of natural waters and sediments, their analysis and classification in order to carry out technical reports on environmental issues concerning to: I) surface water and groundwater pollutions; II) sediment pollution;
- Apply the 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.

• Autonomy of judgment:

The student must be able to carry out a study on pollution of liquid and solid matrices, distinguishing the geogenic contributions from those induced by anthropic activities, knowing and applying the main analytical methods, interpreting the results and elaborating a conceptual model of the studied system.

• Communication skills:

The student must have the ability to describe easily the acquired knowledge, realize and present a technical report, use properly the scientific language.

• Learning ability:

The student must be able to continuously update himself by consulting texts and publications on environmental geochemistry and attending courses, seminars and masters.

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:
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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), environmental monitoring, **(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 (δD and $\delta^{18}O$, $\delta^{15}N$), **(6 hours + 2 hours of lab activities)**

TEACHING METHODS

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

EVALUATION METHODS

At the end of the course one final verification will be planned. It will consist of 6 open-ended questions. A score between 0 and 5 will be assigned to every question. Grades will be based on performance of the students in the six verifications.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Textbook:

- Principles of Environmental Geochemistry. G. Nelson Eby. Thomson-Brooks/Cole, 2004.
- Principles of Isotope Geology (2nd Edition). Gunter Faure. John Wiley & Sons, New York, 1986

Suggested books:

- Geochemistry, Groundwater and Pollution (2nd Edition). Appelo, C.A.J.; Postma, Dieke. AA Balkema Publishers, Netherlands, 2005.
- Environmental and low temperature geochemistry. Peter Ryan. Wiley Blackwell, 2014.
- 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.

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).

EXAMINATION SESSIONS (FORECAST)¹

09/06/2020; 30/06/2019; 14/07/2019; 28/07/2020; 01/10/2020, 27/10/2020, 17/11/2020; and 17/12/2020

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION

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