UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Environmental Geochemistry

2223-1-F7401Q108

Aims

The aim of the course is to enable students to acquire the tools to understand main geochemical processes occurring in the hydrosphere, atmosphere, lithosphere and biosphere. The course will focus on the processes that affect, on local and global scale, the main geochemical features of waters, both surface water and groundwater, soils and the atmosphere. Beside natural processes, the course will face pollution processes. Attention will be given to the effects of climate change on main geochemical processes affecting the hydrosphere and atmosphere.

The course will enable students to understand the effects of anthropogenic activities on the geochemistry of the different environmental matrices, on local and global scale, developing skills useful for the identification and management of environmental pollution problems.

Contents

- Geochemical processes in the hydrosphere, atmosphere and lithosphere
- Biogeochemical cycles
- Pollution of different environmental matrices
- Stable isotope geochemistry

Detailed program

Lectures:

1. Review of basic concepts of geochemistry - atoms, chemical bonding, thermodynamics.
2. Geochemistry of aqueous systems - water cycle and its geochemistry, dissociation reactions, redox

processes, gas dissolution, sorption, aqueous speciation.
3. Carbonate geochemistry and soil weathering - atmospheric and soil CO?; the CO?-bicarbonate-carbonate equilibrium; carbonate and silicate weathering.
4. Biogeochemical cycles - natural and human-modified cycles of carbon, nitrogen, phosphorus and sulfur.
5. Atmosphere and air pollution - atmosphere structure and composition, greenhouse gasses, acid rain, other pollutants.
6. Isotope geochemistry - general principles, water isotopes, environmental isotopes.
7. Contaminant hydrochemistry - nitrate and sulfate pollution, eutrophication, acid mine drainage, landfills, organic contaminants, salinity, chromium, arsenic.
8. Case study analysis - elaboration and interpretation of hydrochemical and isotopic data from a real case study.

Lab sessions:

- Spreadsheet exercises on aqueous geochemistry.
- Geochemical modelling using PHREEQC.
- Field hydrochemistry.

Prerequisites

Basic knowledge of chemistry and geochemistry.

Teaching form

Frontal lessons for 5 CFU (35 hours)

Lab sessions for 1 CFU (12 hours)

Textbook and teaching resource

Slides and other documents provided by the teacher.

Textbooks:

- Environmental and Low Temperature Geochemistry. Ryan P., 2014. Wiley. ISBN: 9781405186124
- Groundwater Geochemistry and Isotopes. Clark I., 2015. CRC Press. ISBN: 9781466591738

Semester

I semester.

Assessment method

Oral exam with :

- discussion of an individual project (analysis of a scientific paper)
- 2-3 questions on topics discussed during the course.

Office hours

By appointment.

Sustainable Development Goals

CLEAN WATER AND SANITATION | CLIMATE ACTION