

MANKARST - HYDROGEOLOGY AND MANAGEMENT OF KARST GROUNDWATER RESOURCES APPLIED TO MINING

Sunday, April 14, 2013, at JW Marriott Hotel Lima

Instructors

Bartolomé Andreo, *Centre of Hydrogeology, University of Malaga, Spain*

Tim Bechtel, *Franklin & Marshall College and University of Pennsylvania, USA*

Groundwater from karst aquifers is among the most important of resources for humanity worldwide. However, because of their unique characteristics, karst aquifers are particularly vulnerable to contamination, particularly from human civil works. In karst, contaminants can easily enter the subsurface and may be rapidly transported over large distances with little filtration. Consequently, engineering in karst terranes requires special considerations, and karst aquifers require special protection. Sustainable management of karst groundwater resources requires a comprehensive understanding of the hydrogeological system. Yet, the very conditions that make karst aquifers particularly vulnerable also make characterization particularly difficult, requiring special investigation methods and data treatments.

Based on these considerations and requirements, members of the Karst Commission (KC) of the International Association of Hydrogeologists (IAH) have organized a course with the following goals:

- Provision of a fundamental understanding of karst systems, their unique nature, importance and vulnerability while clarifying why they require special investigation methods.
- Presentation of the most important investigative methods from geology, geophysics, geotechnical engineering, hydrology, hydrochemistry, and microbiology, as well as tracer test and groundwater modeling.
- Discussion of innovative approaches to karst groundwater quality monitoring, protection and management with local examples, but a global perspective.

The course combines theory, exercises, and case histories, and is designed for geologists, geographers, microbiologists and engineers interested in karst groundwater, as well as for university students (advanced undergraduate, or graduate degree candidates). We hope to welcome participants from academics and industry, in technical or administrative positions.

Program

- 07:30-08:30** **Registration**
- 08:30-10:30** **Lecture 1: Introduction to Karst and Karst Hydrogeology and Engineering**
The origin, structure, and functioning of karst will be introduced, with explanations of the unique hydrologic and engineering characteristics of karst that require special investigative, facility design, and groundwater protection strategies.
- 10:30-11:00** **Coffee break**
- 11:00-12:30** **Lecture 2: Overview and Motivation of Karst Investigation Methods**
Modern methods of karst investigation will be reviewed, including speleological, hydrological, and geophysical methods, as well as the special difficulties and importance of modeling in karst. The importance of combined methodologies will be highlighted with case histories.
- Lecture 3: Engineering in Karst Terrains**
The natural and engineering hazards posed by karst will be reviewed, including the irregular rockhead (pinnacles and grikes), voids and piping in the soil mantle, and bedrock solution cavities. Characterization and mitigation strategies including engineering geology karst classification schemes and rock mass rating, as well as subsidence prevention and repair, will be discussed.
- 12:30-13:30** **Lunch**
- 13:30-15:00** **Lecture 4: Hydrochemistry and Tracing Techniques Applied to Karst Media**
Potentialities of hydrochemistry and tracing (both natural and artificial tracers) techniques will be shown in karst aquifers and how they contribute to understand the hydrogeological functioning of these aquifers. Concerning natural tracers, besides conventional hydrochemical and isotopic tracers other more recently applied (Total Organic Carbon and natural fluorescence) will be considered.
- 15:00-15:30** **Coffee break**
- 15:30-17:00** **Lecture 5: Vulnerability Mapping and Protection Zoning in Karst Aquifers**
Several methods for vulnerability mapping in karst aquifers and case histories for protection zoning of karst springs will be described. Also validation of these approaches will be shown.