

# Short course on GEOLOGY FOR ROCK ENGINEERING PROJECTS

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## TARGET GROUP

### THE AUTHORS

Dr. Vaskou and Dr. Vibert, have both more than 35 years of experience in the field of site selection, site investigation (programme, follow-up & interpretations), design and construction supervision of rock engineering projects for dams as well as tunnels and caverns. They will share with the short course participants their extensive and practical knowledge on site characterisation including the investigation methods and equipment to be used, data acquisition and data validation, as well as design methodologies used for industrial projects.

### MAIN GOAL

The course is suitable for any practitioner (engineer or technical staff) working in the field of rock mechanics and rock engineering, wishing to learn or strengthen their knowledge in the process of validation of input data for rock engineering projects.

It is even recommended to those performing geotechnical computer modelling, who wish to take care of the representativeness and pertinence of input parameters for their computer simulations.

The course is given by practitioners for practitioners: it is organised for helping rock engineers in defining and quantifying the most relevant parameters of rock masses, before or during construction, as well as the methods to be used in modelling and design. Understanding the behaviour of a rock mass requires some basic knowledge of the genesis of rock masses and especially fractures (joints, shear fractures, faults) which is approached through structural geology. Additionally, the knowledge of rock mass characteristics is presented through geotechnical description, in-situ testing and laboratory testing, also in the light of structural geology. The role of fractures regarding the two main issues of underground works – stability and water flow – is emphasized and the existing investigations or design methods to characterise them are addressed. Classical mistakes and traps are pointed out on the basis of real cases. Performing, interpretation and reliability of water tests are presented and the classical approach using Darcian flow is compared to more recent discrete fracture approach via DFN models. The process of design is described along with the aspects and difficulties of hydro-mechanical (HM) coupling during the modelling phase. Then, the construction problems are addressed including monitoring for the validation of design selected parameters and practical application of the observational method. Various examples illustrate the different subjects of the course, all of them being real case studies from various geological situations, worldwide.

### SHORT COURSE DESCRIPTION

The short course is divided in two main parts: site investigation and construction.

Presentations are organised in a chronological order which corresponds to the real project life, from site characterisation (including rock mass classifications) to site modelling and design and last, construction, including mapping and monitoring.

Within the time limitation, the attendees to the Short Course are highly expected to intervene and participate (e.g. share experience and problems) during the Course (), reason for which the number of attendees to the Short Course will be limited to 20 people.

## PROGRAMME

8:30 AM	Registration & Welcome	P. Vaskou & C. Vibert
9:00 AM	Introductory words – Objectives of the Short Course	P. Vaskou & C. Vibert
<b>Morning: Site Investigation</b>		
9:05 AM 9:50 AM	How to organise a Site Investigation: interest and use of an initial structural approach, using stresses, Andersonian modes and structural fracture analysis.	P. Vaskou
9:50 AM 10:30 AM	Rock mass classifications for defining input parameters: interest & limitations	C. Vibert
10:30 AM 10:40 AM	Q&A and coffee break	
10:40 AM 11:30 AM	Data, from site investigation to models: data acquisition with selection of suitable equipment & Procedures for data validation at different scales (matrix and fractures, rock mechanics vs. geology, water flow in fractures versus stress, EPM versus DFN approach depending on projects characteristics, comprehensive site validation)	P. Vaskou
11:30 AM 12:15 PM	Taking into account water in rock engineering: impact on rock mass strength parameters, role of stress regime on 3D geological features, role of groundwater pressures,	C. Vibert
12:15 PM 12:30 PM	Q & A	
<b>Afternoon: Excavation / Construction phase</b>		
2:15 PM 3:30 PM	Validation of design hypotheses and selection of design parameters	C. Vibert
3:30 PM 3:45 PM	Q&A and coffee break	
3:45 PM 4:30 PM	Geotechnical monitoring - Adaptations of design parameters during excavation: theory and practice	C. Vibert
4:30 PM 5:00 PM	Conclusions & discussions	P. Vaskou & C. Vibert



### **Dr. Philippe VASKOU**

Philippe VASKOU worked over 15 years in the field of dams and power houses as an engineering geologist at Electricité de France (EDF). He then spent 24 years with GEOSTOCK, as a geologist expert in Underground Engineering.

His experience in dam sites and hard rock caverns ranges from site selection, definition of preliminary studies and investigation schemes, analysis of results and elaboration of a 3D rock mass model to the seismotectonical analysis of sites and seismic risk assessment.

Throughout his career, Philippe has worked across a wide range of geological and geotechnical environments, from sedimentary to metamorphic, plutonic and volcanic rocks, spanning Europe, Asia, the Middle East and Latin America.

Linking the geological structure to the geomechanical and hydrogeological properties of the rock mass is his favourite area of expertise, with a strong emphasis on the practical elements to get there, such as investigations or sampling. He has given several lectures on this topic at the ISRM and affiliated societies. Philippe is in charge for several years of a specific module on underground caverns and storages, presented at Cergy-Paris University to Master 2 students.



### **Dr. Christophe VIBERT**

Christophe VIBERT is Master of Science, and took his in Ph.D. in Engineering Geology in 1987. He has been working two years as a post-doctoral fellow at the Disaster Prevention Research Institute of Kyoto University, (Japan). In 1989, he joined COYNE et BELLIER, Consulting Engineers, France, (renamed TRACTEBEL in 2008). He has been working on a large number of projects of tunnels (water tunnels, rail- road tunnels, mining) and is presently Expert by STUCKY / GRUNER, Switzerland, especially dedicated to rock mechanics design of hydropower plants or water transfer schemes (large dams foundation, pressure tunnels and large caverns for underground power plants).

He has been a member of the French Rock Mechanics Committee from 1996 to 2018, and its Vice-President from 2012 to 2018. He is now affiliated to the Swiss Geotechnical Society and an active member of the Design Methodology of ISRM. He is also a member of the Swiss committee of Dams and ICOLD (International Committee for Large Dams).