

Engineering geological zoning of the Scorillo Dam site, Romania

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ABSTRACT

A model of engineering geological classification and zoning of the Scorillo Dam site in Romania is proposed to optimise the design of the dam and of the grout curtain. The rock mass was classified into four categories: from 1 (good) to 4 (very poor), according to the rock mass quality (RMQ) at the dam site. Parameters available and used to determine the RMQ were lithology, degree of weathering and fragmentation, rock quality designation (RQD), and modulus of elasticity (E). Based on the study, a new design of the dam, its slopes, and the grout curtain was carried out.

INTRODUCTION

The Scorillo Dam is located in the western part of the Southern Carpathians in the Olteana Valley, and is part of the Bistra - Poiana Marului system. It is designed as a rock-fill structure with concrete screen and with the height of 90 m. The aim of the paper is to propose a model of engineering geological classification and zoning of the dam site according to the rock mass quality (RMQ).

GEOLOGICAL SETTING

The geological studies (Gherasi and Zimmerman, 1967, Gherasi and Savu, 1969) revealed that the bedrock at the dam site is composed of Palaeozoic graphitic schists, quartzites, and sandstones. The structure is quite homogeneous, with 60°–70° dipping foliation/bedding planes, but affected by shallow weathering processes and tectonics. The Palaeozoic formations are overlain by the overthrust mass of chlorite schists belonging to the Zeicani Series (Precambrian). Along the overthrust line, the rocks are highly tectonised. Heavily fractured and brecciated rocks characterise a fault zone in the area. The covering formations have variable thickness and are composed of deluvial, alluvial, and proluvial deposits. A geological cross-section along the dam axis is shown in the Fig. 1 (Durdun 1983).

ENGINEERING GEOLOGICAL INVESTIGATIONS

The engineering geological investigations carried out by Durdun (1983) for the basic design of the Scorillo Dam consisted of:

- drillings with core recovery as well as permeability tests, seismic logging, and determining the state of rock in situ by applying Rock Quality Designation - RQD (ISRM 1978);
- excavation of exploratory shafts and galleries to investigate the tectonised and weathered zones of the bedrock and to characterise the superficial deposits;
- seismic measurements for the determination of the P- and S-wave velocities to characterise the depth and the relief of the bedrock surface, and the physical properties and the weakness of the bedrock along the base of the dam foundation; and
- in situ geotechnical tests (plate bearing tests and shear tests in galleries and cylindrical jack tests in boreholes) to determine deformation modulus and shear strength parameters.

ENGINEERING GEOLOGICAL ZONING

A model of engineering geological classification and zoning of the Scorillo Dam site is proposed to help and to optimise the design of the dam and of the grout curtain. For this purpose, the bedrock was classified according to the rock mass quality (RMQ) in the site. The input data to develop the RMQ classification and zoning were obtained by lithological mapping, visual examination of drill cores, and in situ compression tests. Parameters available and used to determine the RMQ were lithology, degree of weathering and fragmentation, RQD, and modulus of elasticity (E). The type characteristics and values were grouped into four main classes of rock mass quality, presented and described in Tables 1 and 2.

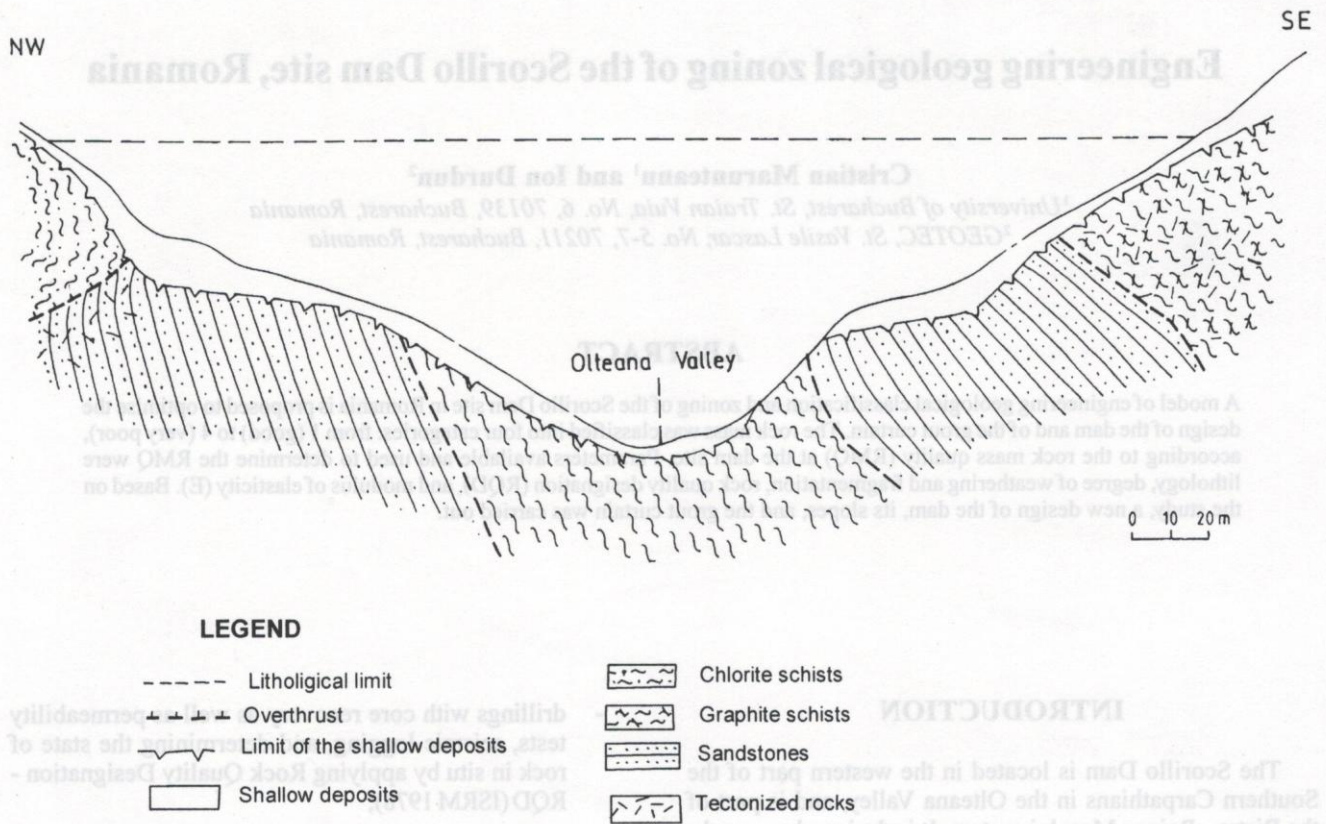


Fig. 1: Geological cross section along the dam axis

Table 1: Rock mass parameters used for RMQ classification

Parameter	Lithology		Parameter	Degree of weathering and fragmentation
A	Chlorite schists	Bedrock	a	Fresh rocks, weak fragmentation
B	Graphite schists		b	Local weathering and fragmentation
C	Sandstones		c	Intense weathering and fragmentation
D	Shallow deposits	Soil	d	Tectonised rocks

The type values were grouped into four main classes of rock mass quality:

- Class RMQ 1 (good): chlorite schists with local weathering and fragmentation, graphite schists and sandstones, fresh rocks and weak fragmentation, RQD > 50%, E = 2500–3500 MPa;
- Class RMQ 2 (fair): chlorite schists with intense weathering and fragmentation, graphite schists and sandstones with local weathering and fragmentation, RQD = 20–50%, E = 2000–3000 MPa;

- Class RMQ 3 (poor): graphite schists and sandstones with intense weathering and fragmentation, RQD = 10–20%, E = 500–2000 MPa; and
- Class RMQ 4 (very poor): graphite schists and sandstones tectonised, RQD < 10%, E = 200–500 MPa.

The determination of the four rock mass qualities from 1 (good) to 4 (very poor) enabled the classification and zoning of the rock mass for the foundation of the Scorillo Dam (Fig. 2).

Table 2: Rock mass quality classification based on rock mass parameters

RMQ		Parameters of lithology, and degree of weathering and fragmentation	RQD (%)	E (MPa)
1	Good	Ab, Ba, Ca	>50	2500–3500
2	Fair	Ac, Bb, Cb	20–50	2000–3000
3	Poor	Bc, Cc	10–20	500–2000
4	Very poor	Bd, Cd	<10	200–500

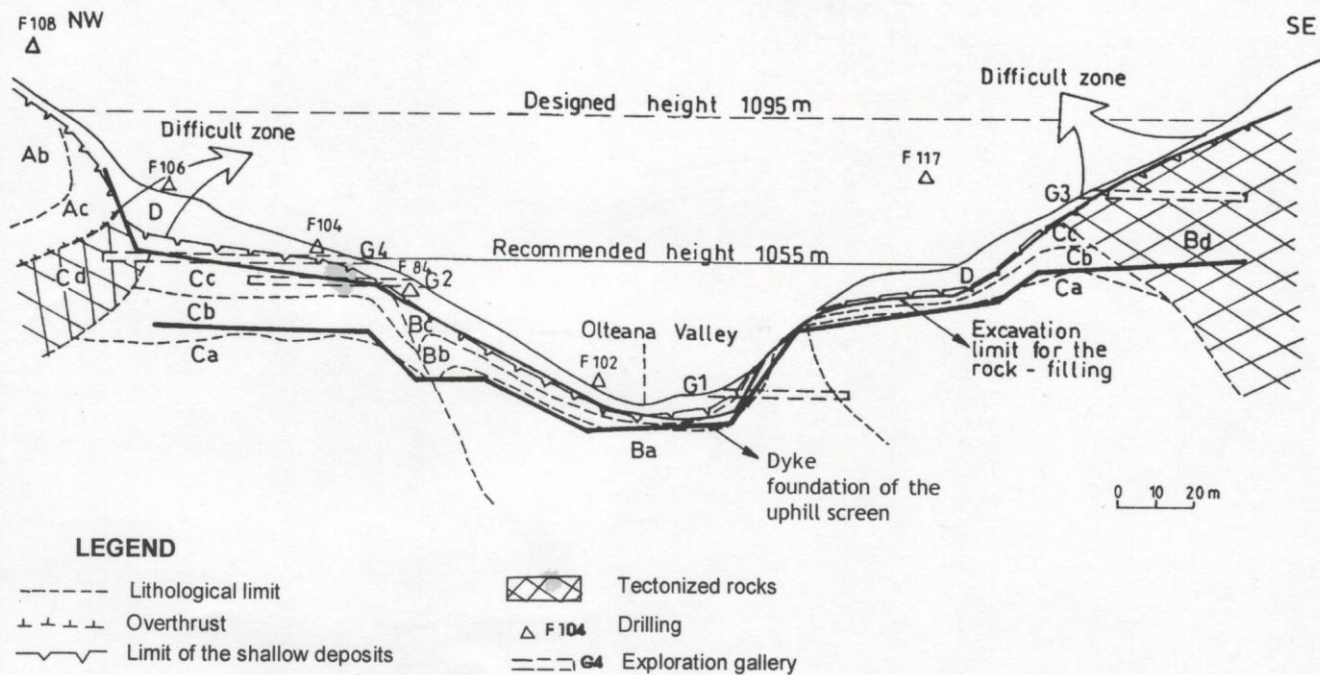


Fig. 2: Engineering geological zoning of the Scorillo Dam site

CONCLUSIONS

The site investigation revealed two sheared and fractured zones classified as RMQ 4 (very poor). The results and the conclusions of the study modified the height of the dam (from 1095 m to 1055 m), improved the working sequence of rock excavation for rock-filling and dike foundation, adjusted the design slope angle and optimised the design of the grout curtain.

REFERENCES

Durdun, I., 1983, Geotechnical and hydrogeological study in the site of the Scorillo Dam (in Romanian). Geological Report, ISPH Bucharest, 48 p.

Gherasi, N. and Savu, H., 1969, Structura masivului granitoid de la Muntele Mic (Banatul de Est). D. S. Inst. Geol., LIV/3, Bucuresti, pp. 56-82.
 Gherasi, N. and Zimmerman, P., 1967, Structura si petrografia sisturilor cristaline din partea de nord a Muntilor Tarcu. D. S. Inst. Geol., LIV/1, Bucuresti, pp. 174-198.
 ISRM, 1978, Suggested methods for the quantitative description of rock masses. Int. Jour. Rock Mech. Min. Sci. and Geomech. Abstr., Pergamon, v. 15(6), pp. 319-368.

Table 2: Rock mass quality classification based on rock mass parameters

E (MPa)	RQD (%)	Parameters of lithology, and degree of weathering and fragmentation	RMQ	
			Quality	Class
2500-3500	>50	Ab, Ba, Ca	Good	1
2000-3000	30-50	Ac, Bb, Cb	Fair	2
1500-2000	10-30	Bc, Cc	Poor	3
500-1000	<10	Bd, Cd	Very poor	4

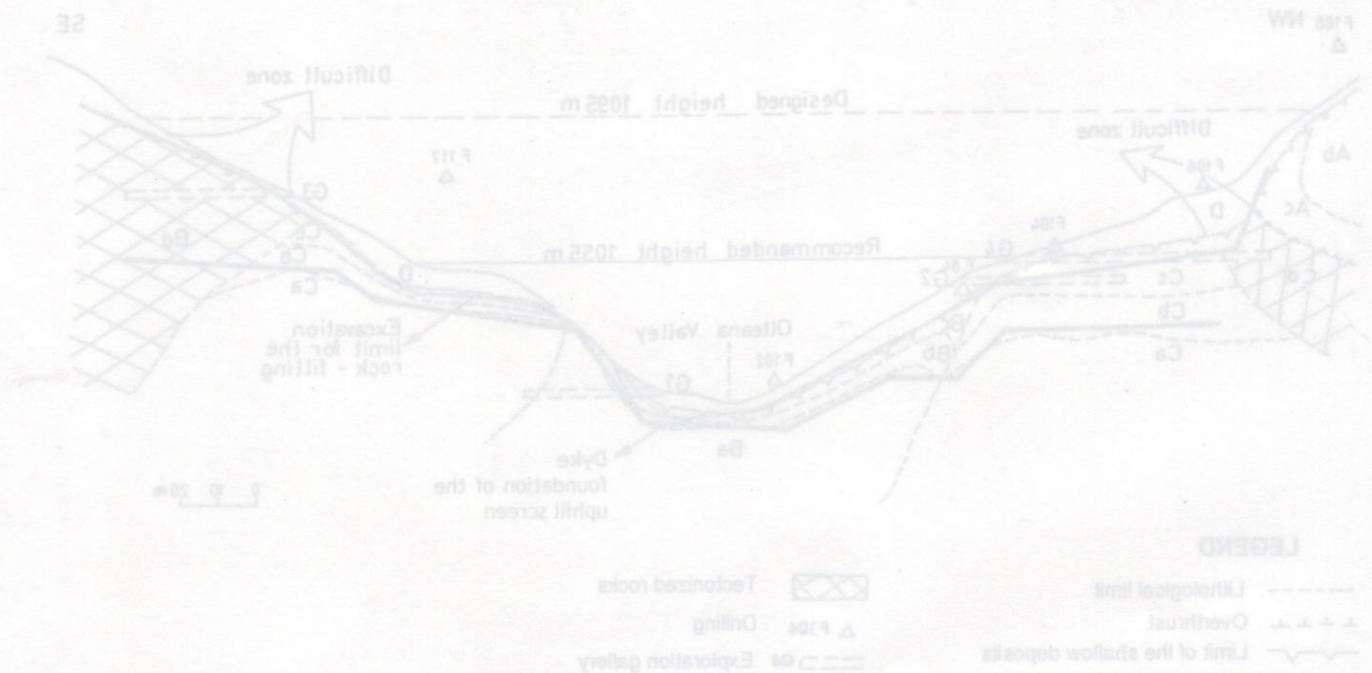


Fig. 2: Engineering geological zoning of the Scorillo Dam site