Methodology for supporting the under touristic development Poliphimos cave in Maronia, Thrace, Greece

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The Cave

The cave is known from the mythology and "Odyssey" as Poliphimos residence. It is under development for touristic purposes and is located in a distance of 5 km from Maronia Town, near Komotini City, in Thrace – Eastern Greece. The cave is full of beautiful stalactites and stalagmites and it is of great palaeontological and touristic interest. The cave is 2000 m long and covers an area of 10.000 m2 [1]. The proposed visiting route is 355 m. The inside temperature is about 16 oC. For the development an integrated study was performed regarding to its geotechnical stability, together with speleological and ecological studies..

Geotechnics

In the present paper the stability conditions were studied regarding to wedge and planar failures. For this purpose, all the tectonic data (of NNW-SSE and E-W directions) were determined and recorded separately for each site in the cave and tectonic and stability diagrams were elaborated, in order to determine stability factors. Furthermore the quality of the rock mass was classified according to RMR method (RMR= 61-70, RQD= 75-90, UCS= 35-60 MPa) and the results were used in order the more appropriate support measures to be chosen.

Initial consideration

A stress-strain analysis as performed in tunnelling is not recommended in cases of natural caves because of the slow procedure of its formation which allows the full relief of the applied stresses.

So the stability analysis of the natural cave is based only on the behaviour of the blocks formed by the tectonic features. The geometry of the blocks formed by the combination of the vertical discontinuities sets with the horizontal bedding creates potential instability conditions, which are mainly related to unstable blocks falling from the roof.

Purpose

The main purpose, after determining any type of potential failure, was to propose the more appropriate stability methods. It is obvious that all the ordinary methods, used in underground construction, are not appropriate for use in caves. Supporting methods have to be adapted, taking into account the already existing natural stability conditions, the safety of visitors and the monumental character of the cave.

Conclusions and Recommendations

According to the stability analysis of the cave, the main failure mechanism is the falling of wedges from the roof. The sides of the cave seem to be stable. For the reinforcement support of the roof, an arrangement of stainless pre-tensioned self-drilling rockbolts is suggested (2X2m and 2X2.5m, length 3m and 5m [Table 1]) as the optimum scenario of intervention, giving safety factors >2 [2].

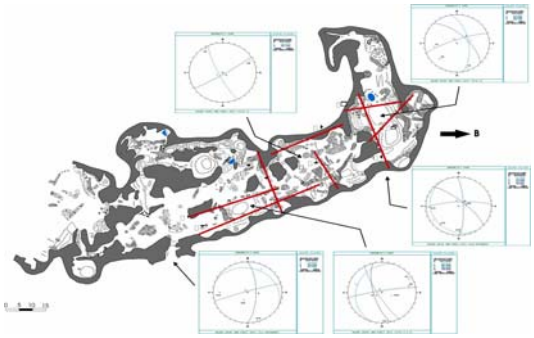
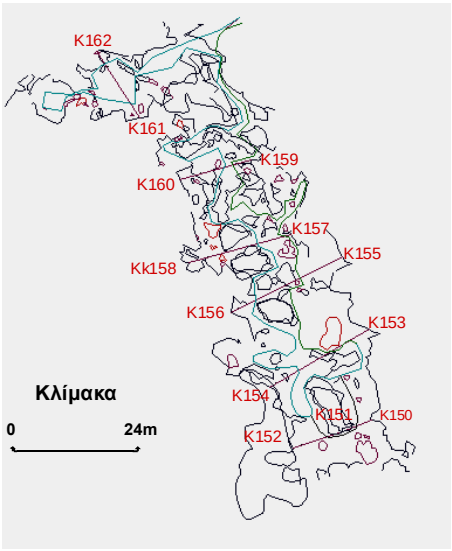


Table 1: Proposed support measures

Section	Potential wedges	Arrangement and length of rockbolts	Safety Factors after bolting
152-151	kl1-kl3-ss2	2,0 x 2,5 m – L=3 m	2,24
	kl1-kl2-ss2	2,0 x 2,5 m – L=3 m	2,04
154-153	kl1-kl2-ss2	2,0 x 2,0 m – L=3 m	3,32
	kl1-kl3-ss2	2,0 x 2,0 m – L=3 m	2,00
156-155	kl1-kl3-ss2	2,0 x 2,0 m – L=3 m	2,33
158-157	kl1-kl3-ss2	2,0 x 2,0 m – L=5 m	2,21
	Kl2-kl3-ss2	2,0 x 2,0 m – L=5 m	2,51
160-159	kl1-kl3-ss2	2,0 x 2,0 m – L=5 m	2,31
	Kl1-kl2-ss2	2,0 x 2,0 m – L=5 m	2,14
162-161	kl1-kl3-ss2	2,0 x 2,0 m – L=5 m	1,97
151-150	kl1-kl3-ss2	2,0 x 2,5 m – L=3 m	2,45



The main direction of the cave is: NW-SE

Joints - Faults	kl1	kl2	kl3	kl4
Mean values (°)	089/68	344/80	246/75	041/77
Stratification	ss1	ss2		
Mean values (°)	032/31	279/17		

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