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The pattern of the tectonic joints and the development of the Vlychada karst show cave in Diros, Peloponnesus, Greece

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Introduction

The most characteristic feature of carbonate rocks is that they are prone to dissolution due to the meteoric water circulation which is enriched in CO_2 . One of the factors influencing this phenomenon is the existence of discontinuities (bedding, foliation, faults, joints) within the mass of carbonate rocks.

This study tries to investigate the influence of rock discontinuities on Vlychada Dirou Show Cave development.





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Location of the cave

The cave of Vlychada Dirou, inhabited since Neolithic times, is located on the peninsula of Mani in Peloponnesus, Greece.



The cave lies 11km south of Areopoli and are signposted near the village of Pyrgos Dirou.

Peloponnesus forms the frontal continental edge of Aegean microplate, close to the zone where Africa subducts below Eurasia.





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The Cave

The location of the cave is matching to the discharge point of the karst aquifer in the sea. Its natural entrance is located about 23 meters west of the current artificial exodus and at an altitude of half a meter above sea level.

The main part of the cave develops first to the SE and then eastwards, while shorter sectors of it are grown to the SW and south, forming elongated chambers, striking NW-SE, N-W and NE-SW.



Most of the cave is flooded and the only indication of groundwater flow from the vadose zone has been in the easternmost sector of the cave.

The cave doors first opened to visitors in 1967.





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Geological setting

The cave has developed in massive to thick platy marbles that belong to the Plattenkalk tectonic unit.

It is the deepest tectonic unit of the Peloponnesus that has suffered greenschist facies metamorphosis and today appears as a tectonic window building the core of the tectonic horst of the Mani peninsula.

A series of terraces at various altitudes with residual coastal deposits signal strong uplift movements during the Upper Pleistocene.





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Geological setting

The marbles are characterized by the development of an indistinguishable foliation / bedding, and they are folded with open to very tight folds with axes striking approximately B-N. They are crossed by various systems of joints, which are superficially open and filled with red soil, while there are strong signs of karstic dissolution.





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Measurements

A series of measurements of the strike, dip and dip direction of the joints in the marbles were made both externally and internally of the cave:

- Along the road leading to the outdoor facilities of the cave.
- Along the path along the coast that externally connects the entrance with the exit of the cave.
- In the lake part of the tourist route.
- On the land part of the tourist route.







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Results

Five joints' systems were distinguished:

A NE-SW joint system which is subdivided into a subsystem with intermediate to low-angle dips towards to the NW-WNW, which is related to the foliation / bedding. A second subsystem characterized as stretching joints of the same strike (elongated joints), but which have high-angle dips, also towards the NW. The latter system intersects the former but is abutting between two or three bedding planes.



- A NW-SE striking joint system characterized as stretching joints with high-angle dips to vertical, which intersects diagonally the two previous. This system easily extends between more than three bedding planes.
- Two systems show E-W and N-S strike with the first one much better expressed. Those joints have developed diagonally to the previous ones. These are mainly shear joints that intersect the first system and are propagated within many bedding planes.





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Stalactites and stalagmites grow in a NE-SW direction that is identical to the elongated joints which form the system that is parallel to the foliation strike. Groundwater flow along these branches may be slower as these branches appear to be restricted between marble bedding.

Conclusions

The chambers of the cave have been developed along NW-SE and E-W directions. The first one is identified with the joint system that has been developed transversely to the strike of the foliation and the second in parallel with the main system of the shear joints.

The bays forming the coastline of the peninsula, have developed in an E-W direction, which coincides with one of the growth directions of the cave and one of the joints systems, which correspond to shear joints.