

Explorations & History

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Review of recent explorations in western Taurus Mountains, Turkey

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Abstract

Caves of the western Taurus mountains have been explored since the middle of the 20th century by different groups from various countries. Following expeditions of the 70s, 80s, 90s and 2000, two major expeditions were organized in 2016 and 2019 in the Western part of the Taurus Mountains, in partnership with a Turkish team from the OBRUK collective. These last projects made it possible to discover more than 250 additional caves ranging from 10 to 250 m deep. Including the results from the past expeditions, this area now entails more than 500 caves over an area of about 500 km². Ranging at relatively high elevation and formed by thick and compact limestone units from Jurassic to Cretaceous, these mountains offer an interesting potential for long and deep caves. The depth potential is about 1'000 m but the main difficulty for the exploration is related to snow as a large amount can penetrate and accumulate to great depths. This finally turns into ice blocking the passage. Recent works offer a synthesis overview of the caves discovered through the different expeditions in the region located between Gündoğmuş and Akseki (the so-called Geyik Dagı massif).

Résumé

Récentes explorations dans le massif du Taurus occidental, Turquie. Les cavités du Taurus occidental sont explorées depuis la seconde moitié du 20^{ème} siècle par des groupes de différentes nationalités. Dans la suite des expéditions des années 1970, 80, 90 et 2000, deux expéditions ont été organisées en 2016 et 2019 en collaboration avec le collectif turc OBRUK. Elles ont permis de découvrir plus de 250 cavités de 10 à 250 m de profondeur. Avec les résultats des expéditions précédentes, la zone (500 km²) compte plus de 500 cavités. Le massif de haute altitude et formé d'épaisses unités calcaires du Jurassique et du Crétacé offre un potentiel important pour de longues et profondes cavités. Théoriquement, le potentiel de profondeur dépasse 1000 m, mais en raison des fortes accumulations de neige dans les cavités, il est difficile d'atteindre les grandes profondeurs. En effet, la neige se transforme en glace et bloque la continuité des passages. Ces travaux récents offrent une synthèse des connaissances dans cette région localisée entre Gündoğmuş et Akseki (massif de Geyik Dagı).

Özet

Batı Toros Dağları'nın mağaraları, 20. yüzyılın ortalarından beri çeşitli ülkelerden farklı gruplar tarafından araştırılmıştır. Batı Toros Dağları'nda 1970'lerde, 1980'lerde, 1990'larda ve 2000'lerde yapılan araştırmaların ardından, 2016 ve 2019 yıllarında, OBRUK Grubundan bir Türk ekibi ile ortaklaşa iki büyük araştırma faaliyeti düzenlendi. Bu son projeler sayesinde, derinliği 10 ila 250 m. arasında 250'den fazla yeni mağara bulundu. Geçmiş araştırmaların da sonuçları dahil olmak üzere, Batı Toros Dağlarında şu anda yaklaşık 500 km²'lik bir alan üzerinde 500'den fazla mağara bulunmaktadır. Nispeten yüksek irtifada değişen ve jura'dan Kretase'ye kadar kalın ve masif kireçtaşı birimlerinden oluşan bu dağlar, uzun ve derin mağaralar için ilginç bir potansiyel sunar. Derinlik potansiyeli yaklaşık 1000 m'dir, ancak araştırma için temel zorluk kar ve buzdan kaynaklanmaktadır, çünkü büyük miktarda karın mağaranın derinliklerine birikmesi sonucunda oluşan buz tabakası, araştırmayı engellemektedir. Son yapılan çalışmalar Gündoğmuş ve Akseki (Geyik Dağı masifi) arasında yer alan bölgede araştırılan mağaralar ile ilgili geniş bir bilgi sunmaktadır.

1. Introduction

Mountains of the western Taurus are a famous karst area for caves exploration. Many expeditions involving Turkish teams and foreigners (French, German, Israeli, etc.) took place in this area since the middle of the 20th century. The relief and the geological context argue for a very promising site where deep and long caves may be found. Due to the

long history and the multiple teams, it reveals difficult today to offer a complete overview of the existing caves which are explored or which are still under exploration. The following sections offers a brief overview of the Geyik Dagı massif, north to Gündoğmuş and of exploration results based on recent expeditions.

2. Overview of the exploration site

The western Taurus mountains are located in the south-western part of Turkey and form an arc around the gulf of Antalya. The massif extends over an east-western axis and results from the alpine orogenesis along the Anatolian fault. It actually separates the Mediterranean Sea from the Anatolian plateau. The highest peak is Mount Kizlarsivrisi (3,086 m) but most of the plateaus and peaks range from 1,000 to 2,500 m of elevation.

From a geological point of view, the massif is composed of folded and thrust series (upper Antalya Nappes) of pure limestones, marls and sandstones resulting from Mesozoic deposits (Jurassic to Cretaceous) that may be overlaid by ophiolitic rocks. The actual morphology results from the accumulation of tectonic units carried from the north with the closure of the Tethys Ocean.

The karstification started in the Miocene as the orogenesis disturbed the southward drainage of the surface water flowing out the Anatolian plateau. Different phases of karstification have been observed (GÜLDALI 1975). These reveal that karst mechanisms and conditions changed over the time. Finally, the actual landscape is also strongly modified from the Quaternary glacial processes - mainly the Würm - but not only (DELANNOY & MAIRE 1983).

First hydrogeological studies date back to the 70s. They focused on the Manavgat river (BAKALOWICZ 1970) and on

the building of the Oymapinar dam. This flooded the Dumanli spring which was probably one of the biggest springs in Turkey. According to BAKALOWICZ *et al.* 1970, the western part of the Geyik Dagı massif (west to Sadıklar) is supposed to be drained toward the Manavgat river (Kemik Döklü spring) while the central and eastern parts (east to Sadıklar) might be drained south eastward.



Figure 1: The Geyik Dagı massif is located in the western Taurus Mountains, north to Gündoğmuş

3. Expeditions

Explorations in this region started in the 50s by local cavers (HİR & ÖZBEK 1994) and were focused on low elevated caves which open in the Manavgat canyon. Most of the explored caves have probably been published in the first global inventories of Turkish caves (AYGEN 1959, CHOPPY 1978 and ÖZBEK 1992).

Foreigners' expeditions in this zone started in the 1960s and major expeditions took place in the 70s and 80s, especially those organized by the Speleo-Club de Paris (1971, 1973, 1976, 1982). Late 90s, Turkish cavers from BUMAK, DEUMAK and OBRUK invest the site and enhance the explorations. It should be mentioned that cave explorations in this area are subject to authorization from the Cave Conservation Division (General Directorate of Nature Conservation & National Parks, Ministry of Forest & Water affairs).

In the 90s, different expeditions were organized. The main one is probably "YORÜK 1991". About 50 caves have been inventoried and mapped; the biggest one being Nashu Obrugü (development: 270 m, depth: 208 m). Other expeditions, more "diving-oriented" also worked in the area, ex: Manavgat 1992, Magara (1993, 1994, 1995), ADEKS 1994, Expédition Savoie-Turquie 1997, ARKADAS 1998, etc. In the first decade of 2000, two main foreigners' expeditions occurred on the Geyik Dagı: the Swiss expedition in 2005 (PERRET & PERRIN 2005) and the French expedition in 2007 (MALARD 2007).

In 2016 and 2019, two expeditions in this region have been organized in collaboration between OBRUK (Ali Yamaç & Bülent Erdem) and Continent 8. Information and results are published in Spelunca (MALARD 2018, LOUIS 2020).



Figure 2: Upper zones of exploration in the Geyik Dagı massif (expedition TE2016, ©Yann Auffret)

In the frame of these last expeditions, an exhaustive review of the previous expedition results made it possible to establish a synthesis map of the existing caves (see Fig. 3). This work is completed with the coordinates of caves from "old" expeditions which have been collected from reports and converted to a common geographic system. This work is not always easy as most of the caves were not exactly pointed out on the field with a GPS. Most of them were reported on a pseudo map made by hand as official maps are still extremely difficult to obtain.

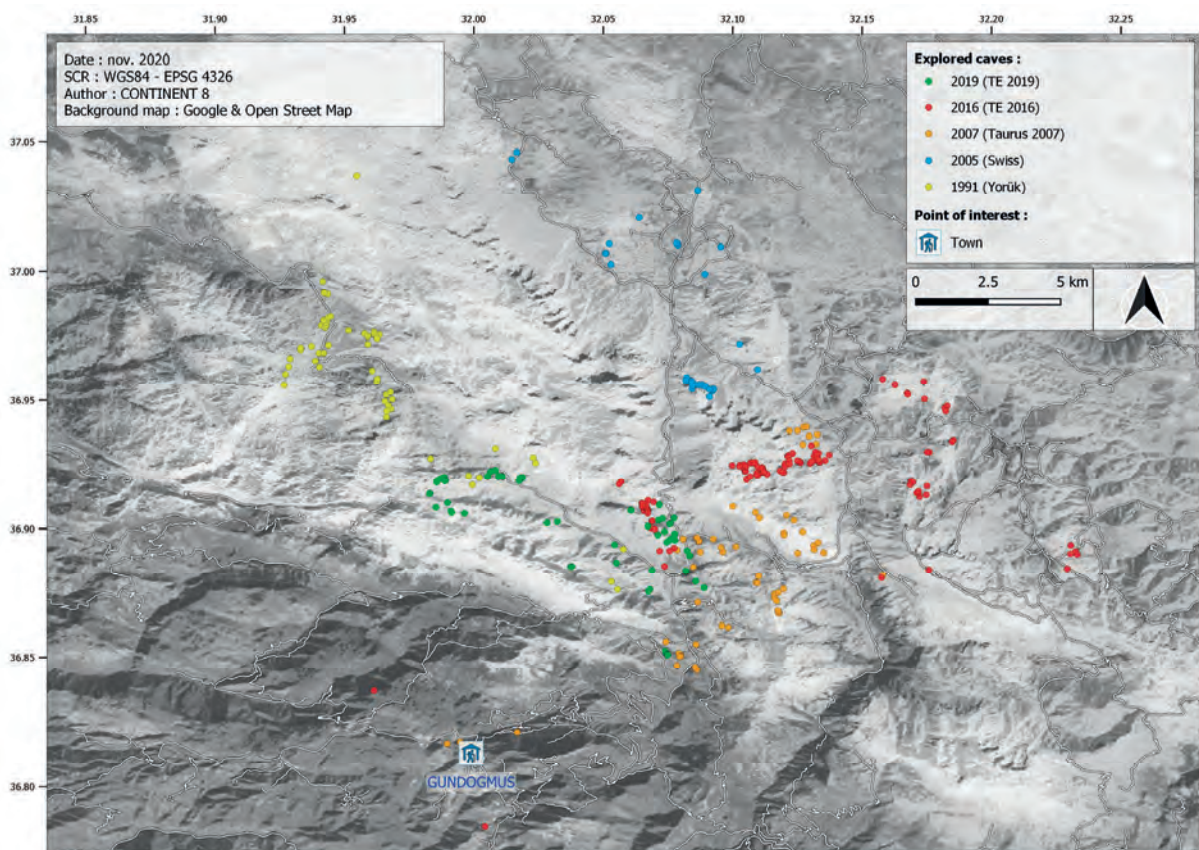


Figure 3: Synthesis map of explored caves during the 1991, 2005 (Swiss), 2007, 2016 and 2019 expeditions.

4. Caves

More than 500 caves have been inventoried in the Geyik Dagı massif. This inventory probably underestimates the real number of caves which have been explored in this area due to the lack of global inventory and of coordination between active teams. Moreover, it happens that few caves may have been explored and mapped twice, adding confusion in the synthesis. The Fig.4 shows an overview of the depth for 283 explored caves. Two-third of the explored caves do not exceed 20 m in depth and less than 20 caves are deeper than 100 m.

Explored caves can be sorted in two categories: the high elevation caves and the low elevation caves.

Caves of high elevation (i.e. > 1'800 m a.s.l) are of alpine type, formed by vertical shafts and meanders. Entrances the caves open in denuded karst areas which are covered by debris blocks resulting from the erosion. From a geomorphological point of view, these zones are a succession of dolines or closed depressions of moderate to big extends. Huge entrances can be found (i.e. pits of 30 to 40 meters) but most of the entrances are meanders that open along the flanks.

Whatever the type and size of the entrance, all caves show a huge deposit of snow at the bottom of the first pit forcing to search for passages between the snow and the rocky wall (Fig. 5). Some of these caves are known from local shepherds who collect the snow to get water. They usually install a wood ladder and leave shovels and buckets on site.

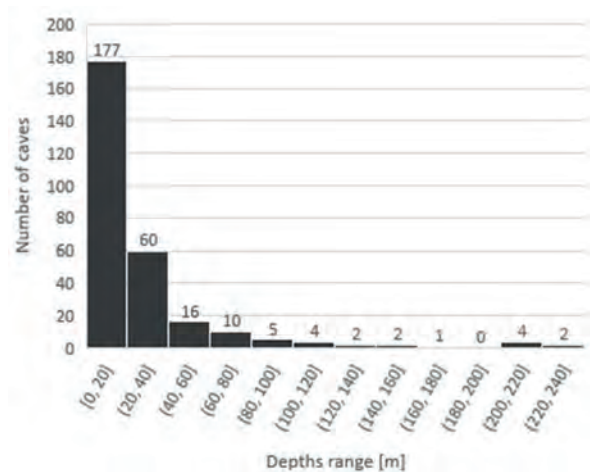


Figure 4: Overview of the depths of the explored caves in the Geyik Dagı massif (based on a statistical analyze of 283 caves).

Snow deposits often extend downward up to a depth of 150-200 m and finally turn into ice blocking the passages (ex: Keçi cave (-153 m, 2007), Polar Bear cave (-60 m, 2016), etc.).

In the Two Girls cave (-86 m, 2016), the amount of snow is roughly estimated about 200'000 m³ and fills an 80 m deep shaft! Such huge accumulation of snow might be of high interest for different purposes.



Figure 5: Laurence explores a passage dug in the snow at the contact with the rock. Under the snow cap, the cave extends for another 50 m (expedition TE2016, ©Arnaud Malard).

From the hydrogeological point of view, snow melting is supposed to contribute to groundwater recharge in the dry season maintaining the springs discharge. From the paleoclimatic point of view, these annual layers of snow may reveal crucial information for the past climate and paleo-environment. But, from a speleological point of view, the

snow is probably the first obstacle to pass through in order to go downward in the caves. However, with the global warming, most of the high elevated caves can be reviewed in the coming years as new passages may open between ice and rock walls.

Caves of lower elevation (i.e. < 1'800 m a.s.l.) may present various forms. Alpine and vertical caves can be found as well as pseudo horizontal caves of phreatic origin. At that elevation, there is less snow in caves and chances to find deeper cavities might be higher (ex: Gouffre du Belge Blasé -220 m, etc.).

Up to 1'000 m a.s.l, most of the caves with obvious entrances have been occupied in the past by shepherds or for other uses (see the case of Genifi Ini cave (YAMAÇ et al. 2018) which has been converted into a Christian church.

Besides the usual risks related to caves exploration, dangers related to bears must be mentioned as some of them may occupy the caves. Indeed, shepherds are regularly attacked when they lead the herds to the pasture and in 2019 a member of the exploration team has been injured by a bear at -70 m in a cave!

5. Conclusion

Although numerous teams already worked or still work in the western Taurus, the caves exploration in the Geyik Dagı massif is still in its early stages when looking at the huge surfaces and the high elevated reliefs. The depth potential is high but the main obstacle to overcome is snow as it obstructs most of the caves located at elevation higher than

2'000 m a.s.l. Currently, promising areas seems being located at elevation lower than 1'800 m a.s.l. Increasing collaboration between teams and working on a huge work of synthesis would be very helpful to manage the next expeditions.

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