RHAR BOU'MAZA
The underground river Tafna

Resume

Le fleuve Tafna coule dans l'ouest de l'Algérie, depuis les Monts de Tlemcen jusqu'à la Méditerranée. Il prend sa source dans une région karstique. Pendant les crues, la rivière jaillit directement d'une grotte qui est la plus longue (18,4 km) connue en Afrique: Rhar Bou'Maza (littéralement,''la grotte du père à la chèvre''). 4 km en amont de l'entrée, un siphon a bloqué les explorations jusqu'en 1982. Depuis, d'immenses galeries ont été explorées et ce n'est pas fini. A part le siphon, la principale difficulté d'exploration réside dans la longueur même de la cavité qui rend nécessaire l'installation de bivouacs en amont du siphon.

Cette rivière souterraine draine un grand synclinal (120 km2) où affleurent partout les calcaires et les dolomies jurassiques. Les eaux souterraines sont sursaturées et déposent tout au long de la rivière et en aval de grandes cascades de travertins.

Riassunti

Il Fiume Tafna é situato nella parte occidentale dell'Algeria e scorre dalle colline Tlemcen verso il Mar Mediterraneo. Durante i periodi di piena il fiume emerge da una grotta che é la pui lunga (18,4 km) fra quelle esplorate in Africa: Rhar Bou'maza (alla lettera: "La cava del padre capra''). Le parti principali della grotta sono chiuse da un sifone, 4 km dall'entrata, e sono state esplorate solo negli ultimi anni. La maggior difficoltá nell'esplorazione é la lunghezza della grotta e fú necessario installare un'accampamento al di lá del sifone.

Il fiume sotterraneo drena una larga sinclinale (120 km) dove tutte le rocce affioranti sono formate da calcarie dolomie Guitassici. L'acqua é sovrassatura di calcite e forma grandi barriere di travertino lungo tutto il corso del fiume sotterraneo e anche sotto l'entrata della grotta.

Introduction

The Tafna River flows from the Tlemcen Hills in western Algeria to the Mediterranean Sea. During periods of flood it springs from a cave which drains a wide syncline of 120 sq.km. This cave, Rhar Bou'maza (meaning literally : "The cave of the goat father"), is the longest cave so far explored in Africa at 18,400 m.

The cave is difficult to explore as the main parts are beyond a 30 m long 5 m deep sump, 4 km from the entrance. The water is over-saturated with calcite and forms large travertine dams all along the course of the underground river, creating long, deep lakes which necessitate long swims or the use of a boat.

Because of the distance involved it is necessary to bivouac beyond the sump to explore the further reaches of the cave.

These large rounded pebbles are not made from limestone but from pieces of travertine.
Photo : B.Collignon

B E R N A R D

C O L L I G N O N

Progressing by boat along the "Lac de l'Ennui". This is a typical scene in the river passages of Rhar Bou'maza. Photo : P.Benoit

Geology

The Tlemcen Hills are situated along a large horst, limited by main faults to the north and south. They dominate the arid High Plains in the south and the folded Tellian Atlas to the north. The whole horst is orientated WSW-ENE and is divided by plenty of parallel and orthogonal faults orientated N60E and N150E (*Fig.1*).

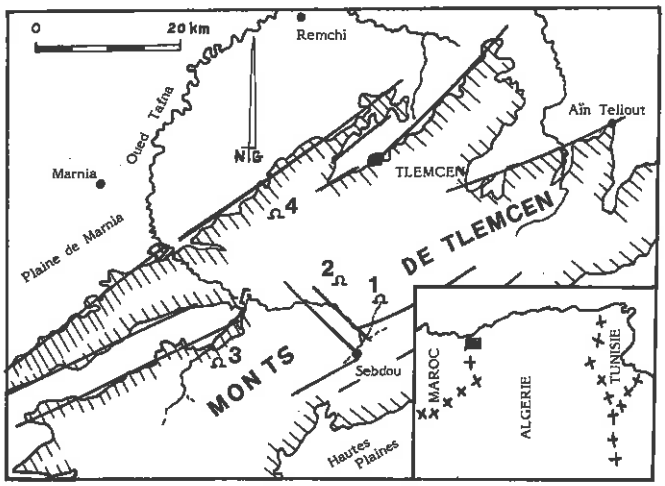


Fig.1 Location of the Tlemcen Hills, the main underground rivers, and the big faults limiting the horst. (1) Rhar Bou'maza (2) Aïn Bir Tessa el Kbira (3) Rhar el Khal (4) Aïn Bou Irzhen

Most of the outcrops are made of Jurassic limestones and dolomites, the latter being the most abundant. They are saccharoidal and altered into a dolomitic sand which fills all the fissures and diaclases. The lower layer (Tlemcen dolomite) is the thickest (400 m) and the underground river Aïn Bir Tessa has excavated its path through these beds. Most of the larger caves like Rhar Bou'Maza are situated in the upper layer (Terny dolomite)(*Fig.2*).

Climate

Western Algeria is very dry and most of it receives less than 400 mm of rain per year. The Tlemcen Hills are moderately less dry as they highly dominate the plains situated between them and the sea. The total annual rainfall reaches up to 1000 mm with an average of 600 mm. 20% of this rain seeps into the limestones and resurges at the foot of the hills.

The climate is mediterranean, with a hot and dry summer season and a sweet wet winter. During the dry season the temperature soars to 35°C every day. There are no storms and underground floods are uncommon in summer. The rainy season lasts for 7

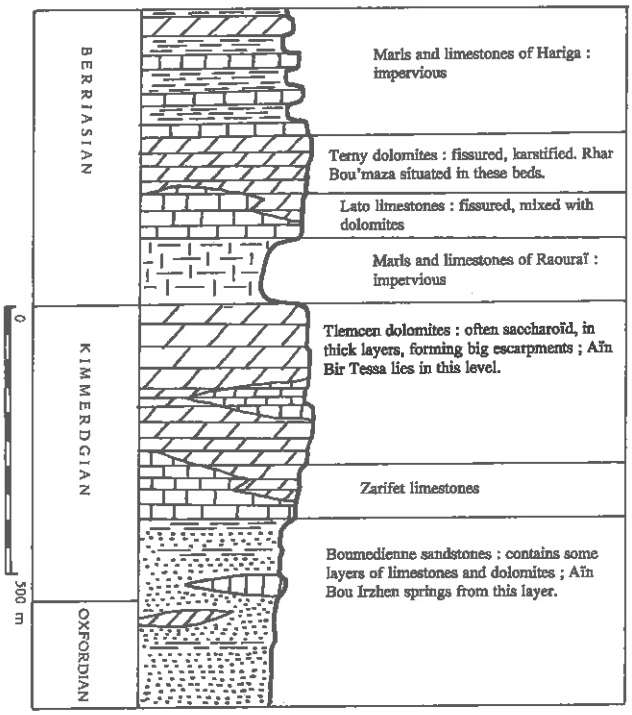


Fig.2 Lithostratigraphic log in the Tlemcen Hills

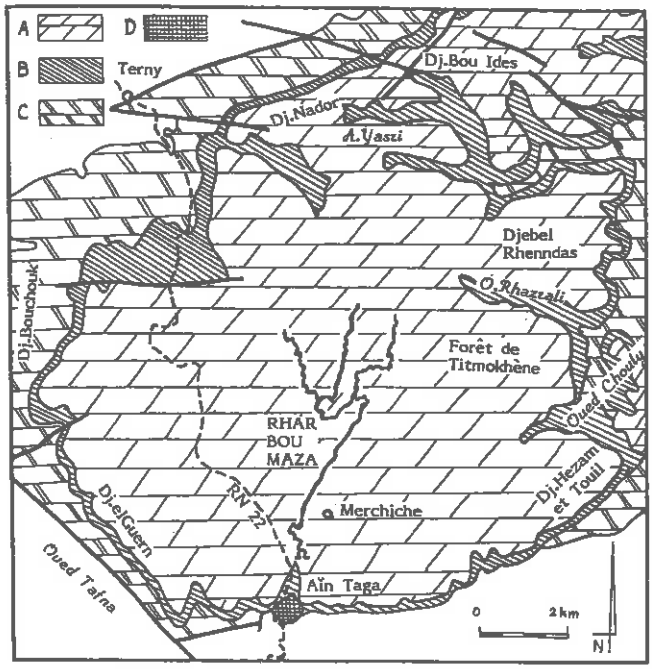


Fig.3 Geological map of the area.
A : Terny dolomites B : Raouraï marls & limestones
C : Tlemcen dolomites D : travertines

months, from October to May, with most of the rainfall associated with very big depressions. The weather is therefore quite predictable. In winter, there is snowfall on the mountains and hills above 1200 m asl.

Description of the Cave

The entrance to Rhar Bou'Maza is situated near the RN.22 road and below a large cave where animals take advantage of the cool shade during the hot summer months.

The cave begins with a lake where the rocky bottom is clearly visible through the crystal clear water. From here to the sump, 4 km distant, most of the galleries of the cave contain lakes and rivers.

The passage section is large, 50 to 100 m2, and comfortable. The ideal personal equipment is a neoprene suit, high boots, fins, and a tyre inner tube or boat.

The underground river is followed for most of the 4 km to the sump. There are only three places in this part of the cave where the water is left briefly to walk over fallen boulders. Elsewhere, you have to swim a series of 20 long lakes separated by gour dams.

The sump is short and not very deep (30m long -5m deep) (*Fig.4*). Nevertheless, you need to be a good diver as you have to swim several hundred metres before and after the sump and to pass four short underwater passages.

700 m beyond the sump lies the best camping place in the cave. It is a clean travertine flagstone, near the water, and we used this in 1983 and 1984. Unfortunately, it is far from the last parts of the cave to be explored, and in 1985 we installed the bivouac further on, at the crossing of two river branches. The journey with all the camping and diving equipment to this place was very hard !

The river divides itself into three branches. The

LEFT At the start of the "Lac de l'Ennui" which is 600 m long. Photo : P.Benoit

west one (galerie du Gypse and Ad augusta per angustam) is the largest. Part way along this passage is an upper gallery with gypsum flowers. A 30 m rope is required to rejoin the river. The upper part is very, very large and high. Unfortunately, it is closed by a large boulder choke and we were unable to find the continuation.

The north branch (A tout hasard) is smaller and the river turns and meanders between clay banks. After 500 m, the gallery is very high. The ceiling has collapsed and the water passes under the rocks. 1500 m beyond the crossing, it is possible to climb on such a collapsed roof and to reach an upper gallery which is full of very nice speleothems. It is the only place in Rhar Bou'Maza where the river passage intersects such an old fossil cave. Further on, the river continues to a 5 m waterfall, where we were stopped by the lack of ropes and pitons.

The north-west branch (Escalade shuntée) is quite long. It begins with a very large collapsed gallery ending at the bottom of a clay wall which is difficult and "fun" to climb. When the water level is low, it is possible to pass below this wall but a short dive is necessary. Upstream, the passage becomes narrower and in 1984 we stopped when it became too difficult to advance wearing a neoprene suit.

Discovery of the Cave

The local people have known the cave for centuries but it was not until 1935 that it was explored by colonial farmers. Mrs Dolfuss, Dupuy and Souhaut reached the sump, 4 km from the entrance. In 1947 a survey was drawn by Birebent and between 1952 and 1959, Bourette, Larat, Marquet and Petitdidier, tried unsuccessfully to dive the sump.

Where the ceiling has collapsed you have to climb over the rocks. Note that the ceiling now lies along a thick limestone layer. Photo : P.Benoit

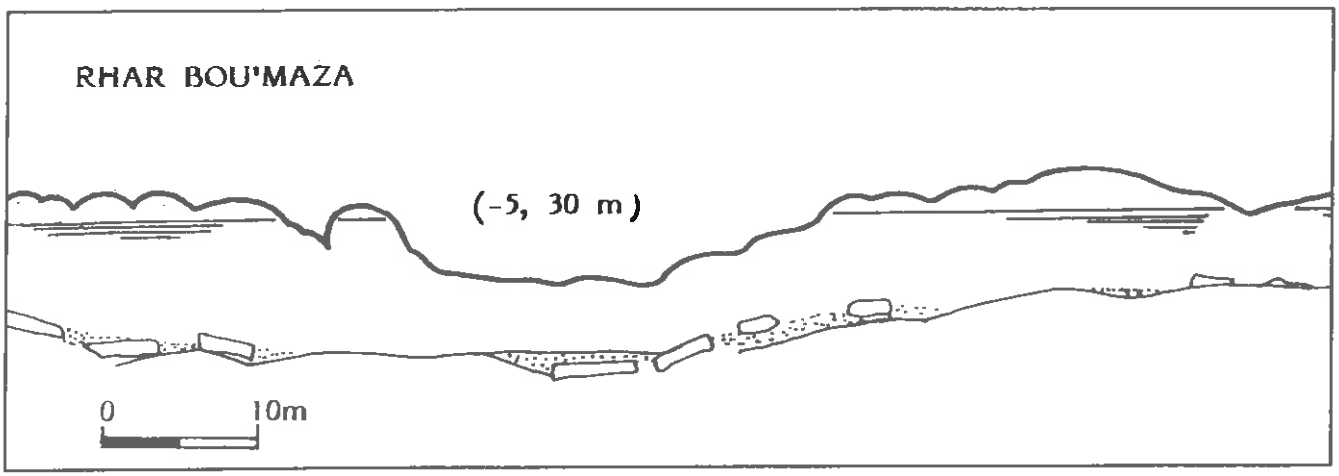
The independence war stopped the explorations up to the summer of 1982 when the author dived the sump for the first time. During the following winter, he explored a further 2 km with Bernard Pablo and Michel Petitbon. During the following years, three more expeditions took place with the same divers plus Brigitte Pablo, Paul Benoit, and Jean Philippe Melano. Each year a further 3 to 5 km of passages were surveyed and the cave became the longest known in Africa (18.4 km).

The exploration has not yet finished but the journey to the furthest reaches of the cave is now very long. It is difficult to make further progress without a long underground camp. It is a big job, but km of big unknown galleries are waiting.

The Water

The water flow in Rhar Bou'Maza is very

Fig.4 Diagram of the sump which closes the cave, 4 km from the entrance.



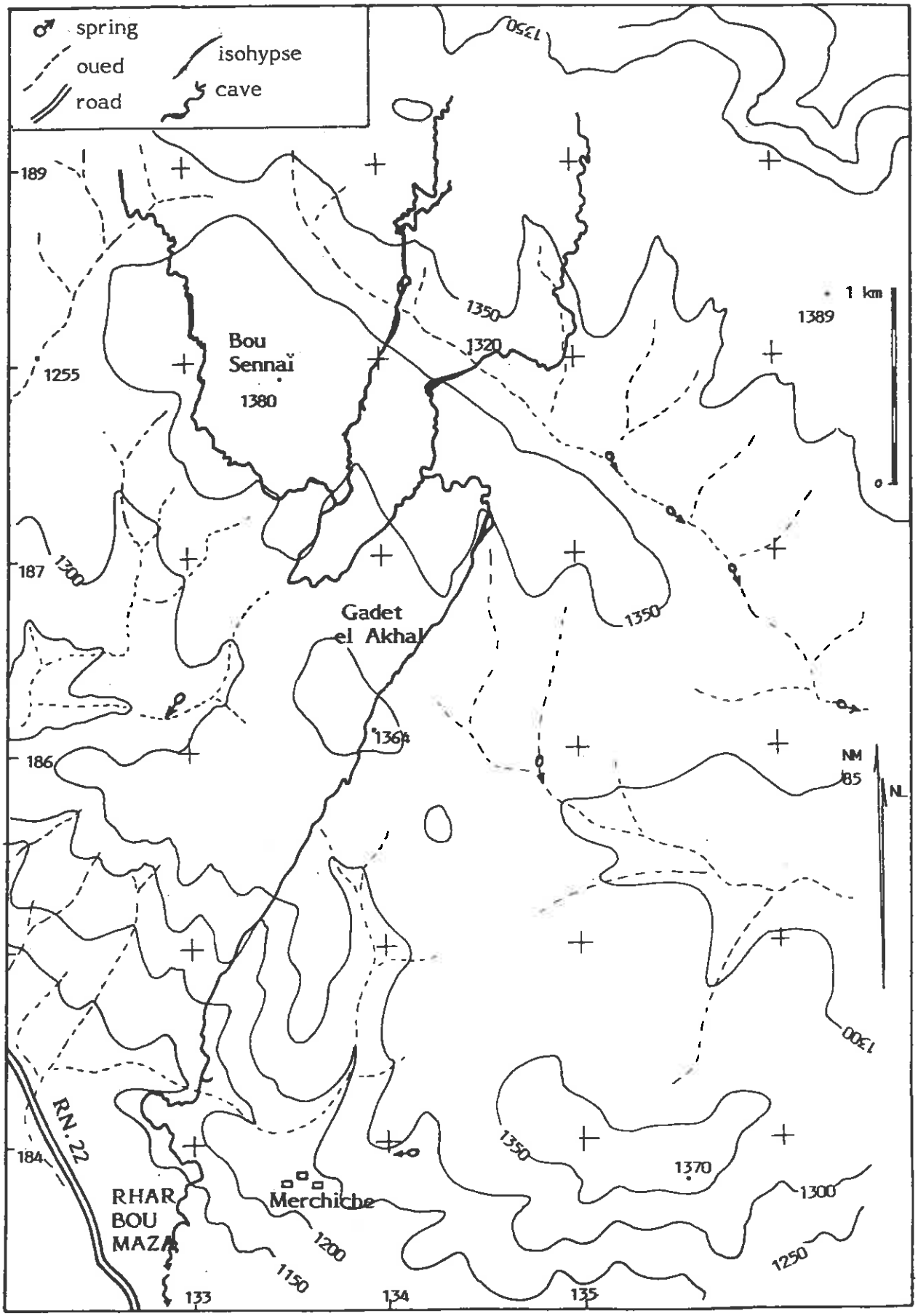


Fig.5 Map of the cave. Superficial relief and underground drainage network are completely independant.

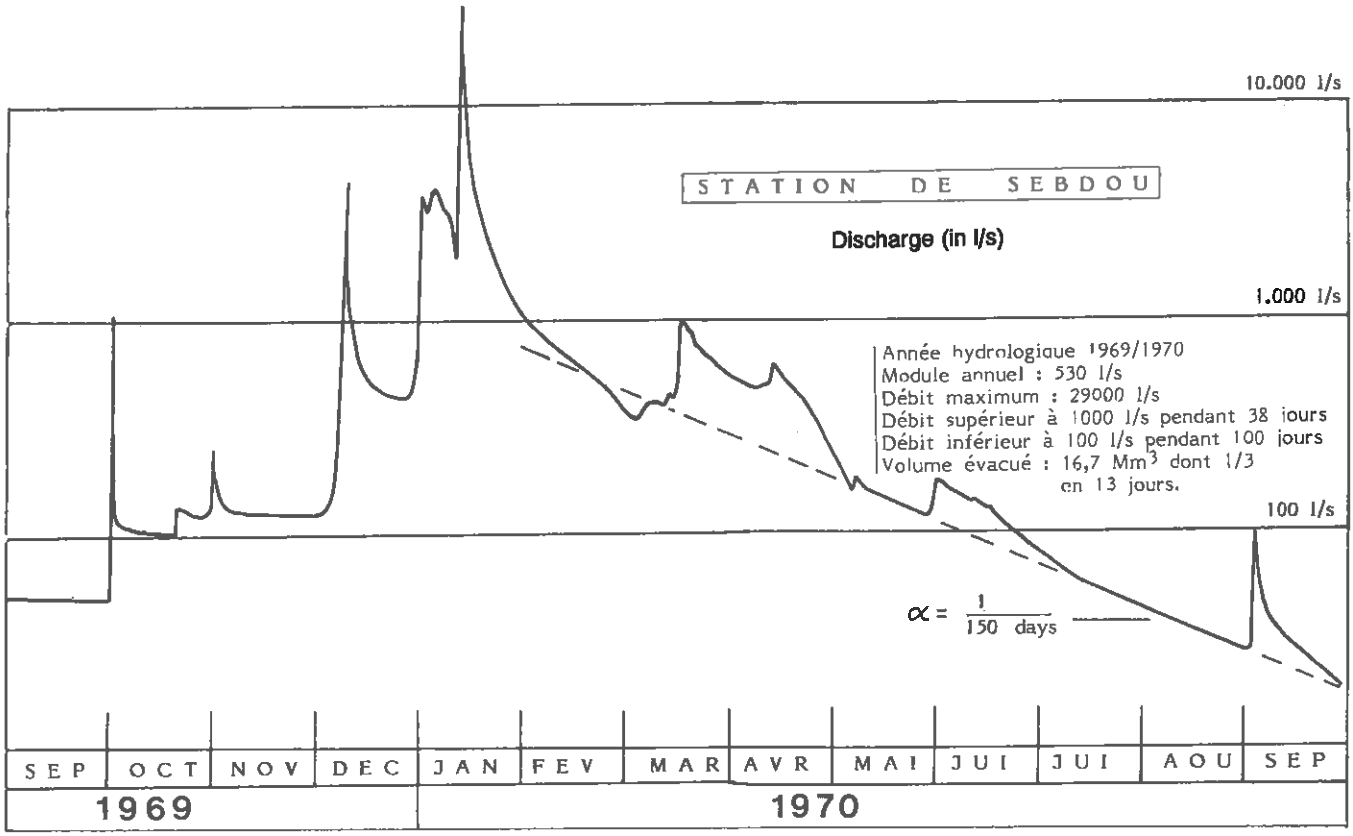


Fig.6 Chart of the water discharge during the year 1969/70. The annual runoff is 16.7 Mm3 and the mean annual discharge is 530 l/s, peaking at well over 10000 l/s in the winter.

irregular (*Fig.6*). During the floods, the discharge can reach up to 10 cumecs and sometimes 20, but during the long dry season the flow is as little as 0.05 cumecs. That is the best time for exploration.

The composition of the water is normal for karst and contains mostly carbonate, calcium, and magnesium. The Ca/Mg ratio is higher than 2, which is unusual in this dolomitic region. It is likely that the cave was able to develop more easily in the limestone layers which are not the most abundant but capable of forming large vaults.

During non-flood periods, the water sinks in the floor of the cave and resurges at Aïn Taga, 500 m south of the entrance. We have explored the main sinkhole during a dive of 100 m along a narrow and muddy passage.

Speleogenesis

The cave lies in the centre of a large syncline which extends over the whole outcrop (*Fig.1*). It collects most of the water sinking in the area and Aïn Taga is the only large spring.

In spite of our long research, we were unable to find any ancient passages above the cave. The collector of the underground water in this area has probably always been Rhar Bou'Maza. The resurgence lies exactly on the lowest point of the outcrop.

The history of the cave appears to be simple. Before the Miocene, the region was quite flat and the rivers were probably flowing above the karst to create the present dry valleys. During the Upper Miocene (Tortonian), the area was raised several hundred metres above the neighbouring regions. The water slowly enlarged underground crevices and carved out large channels. The largest passages are situated at the lowest part of the syncline, which is also its centre. The underground network is completely independent of the old dry valleys. The river below the resurgence is unable to excavate a deep bed as it is in contact with the impervious marls.

So the present entrance is probably as old as the cave itself and the first several kilometres of passage are no higher than 5 m. In the upper parts of the cave, the water level is higher and even now the

river continues to dig its bed deeper and deeper. In this part of the cave, some of the galleries are more than 40 m high.

A peculiarity of the cave is the high number of calcite dams (gours) which divide the river into more than 50 lakes. This means that the water is oversaturated during some seasons and indeed, it carries a large amount of hydrogenocarbonate throughout the year (over 400 ppm). The only place in the cave where you have to walk bent over, is a big gour where the travertine is growing up to the ceiling of the gallery.

Other Caves in the Area

Rhar Bou'Maza is not the only cave in the Tlemcen Hills. Two other underground rivers belong to the longest one in Algeria: Rhar el Khal (Black Cave) and Aïn Bir Tessa el Kbira (The Big Cave of the Ninth Well). Both are resurgences, and you must dive short sumps to explore them.

On the top of the plateau, many shafts have been explored, but unfortunately none of them reaches the underground streams. They are mostly filled by the dolomitic sand and in the underground rivers you find nothing which has come from outside (wood, leaves, etc.).

All these caves are described elsewhere (*Collignon,1991*).

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