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# ECOTOURISM AND CULTURAL INTEREST OF A NATURAL SITE: KARST LANDSCAPE IN A CAVE OF EL KAF IN THE ORIENTAL REGION OF MOROCCO

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## Abstract

The site of the El Kaf cave in Sefrou is located in the rural town of Aïn-Sfa, 30 km north of Oujda city that is in eastern region of Morocco about many kilometers from the Moroccan-Algerian border. It's an ecotourism site with a source of water purity and benefits from an impressive geomorphological quality to visit.
In terms of the process of mobilizing underground ecotourism in Morocco, it is interesting to conduct a study of tourism development, geoscientific importance and the use of a cultural dimension. El Kaf cave presents a much richer history, requiring the support of scientific interpretation and a tourist guide. This geosite therefore describes the historical relationship between the men of yesteryear and the environment that surrounded them. Although this geosite benefits from a protection status of the rural municipality, it remains threatened and damaged by human actions.
The results of this study could be used in the proposal of an ecotourism development plan for the geosite studied, valuation and associating the scientific with the cultural, which can be applied to caves of similar cultural interest.

**Keywords**: Karst, El Kaf cave, Ecotourism, Culture and history, Northeastern of Morocco.

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## Introduction

Nowadays, the use of computers and digital survey processing techniques makes it easy to carry out morphometric analyzes of caves and karstic systems. Cave levels are one of the morphological features that have been repeatedly proposed as a consistent indicator of karst evolution phases [20]. The caves have been the subject of excavations and studies, some of which are still ongoing today [11].

The caves which, due to their configuration, have a largely clearly defined space, however, do not have a natural delimitation at the level of the entrance, especially in the case of open caves. Among the natural sanctuaries, the caves have the advantage of being able to be identified and analyzed both through literary and iconographic sources and through archaeological discoveries [15]. The essentially vertical organization of the karst is the culmination of karstification, a set of evolutionary processes, associating physico-chemical alteration and mechanical alteration, which widen the initial voids of the surrounding rock to gradually achieve the formation of drainage structures organized along the along preferential underground flow paths. The factors, and their interaction, which control karstification are divided between passive parameters (lithological, tectonic, etc.) and boundary conditions (hydrodynamics between the surface and the subsoil, etc.) [9].

Karst landscapes are characterized by forms of surface corrosion (sinkholes, lapies, sinkholes, dry valleys, losses, resurgences, etc.) but also by the development of cavities by underground water circulation. Hence the limestone massifs are characterized by the existence of numerous chasms, cracks, caves, canyons and underground lakes [14].

Underground cavities generate a risk of landslides that could jeopardize the safety of goods and people on the surface. Anthropogenic cavities (mines, quarries, cellars, war mines, etc.) are the subject of numerous technical documents for the management of this risk, from their detection to their mitigation, and this at all scales of study. Natural cavities have particularities that involve adapting reasoning and practices [4]. As in other regions of the world, pioneering work in prehistoric archeology in Morocco has been concentrated in easily accessible areas. Some areas have thus benefited from numerous research works since the beginning of the 20th century. [11].

This allowed us to discover a remarkable archaeological site. It is an open cavity within a mountain range forming in the Beni-Snassen massif of the Oujda region, by Karstification phenomenon in Jurassic carbonate rocks. The site occupies a strategic position and was a very favorable place for the settlement and development of prehistoric human activities.

**Description of the study area**

The Aïn-Sfa commune, covers an area of 231km², and a population of 4,490 individuals according to 2014 statistical data, it includes approximately 1019 families spread over 49 'Dwawir' districts. The rural commune had been constituted since the 1960s, and was included in the 1992 electoral campaign from which the rural commune Labssara emerged.

The inhabitants of Aïn Sfa are a branch of the Beni Snassen (Fig 1) tribe and they are of Zenati Khalifa origin and are divided into branches which settle from the East to the West of the Beni Snassen mountain range or 'Beni Znassen ' as follows: (Ouled Zaïm and Ouled Elgadi 'Beni Khaled subdivision'; Beni Khelouf and Beni Marissen 'Beni Mengouch subdivision'; Beni Mimoun and Beni Moussi 'Beni Atigue subdivision'; Beni Mahyou 'Beni Ourimmech subdivision')(Fig 2) ; The Beni Snassen are bilingual, among themselves they speak Berber, and with other foreigners and the authorities, they speak Arabic [10] [13] [21] [24].

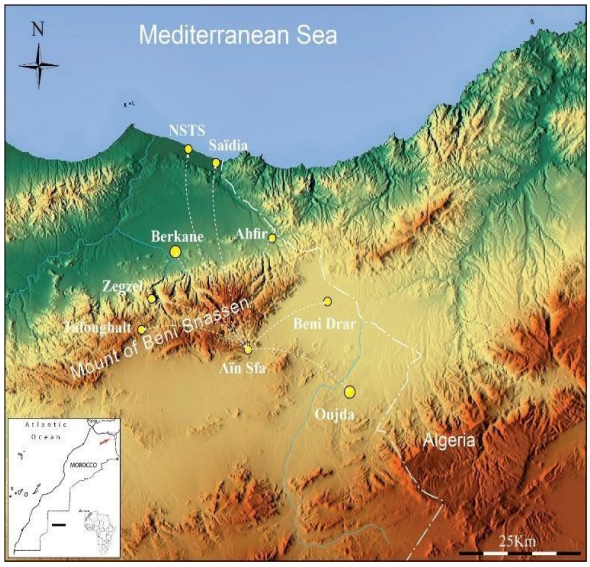


**Figure 1: Ain Sfa and nearby towns**

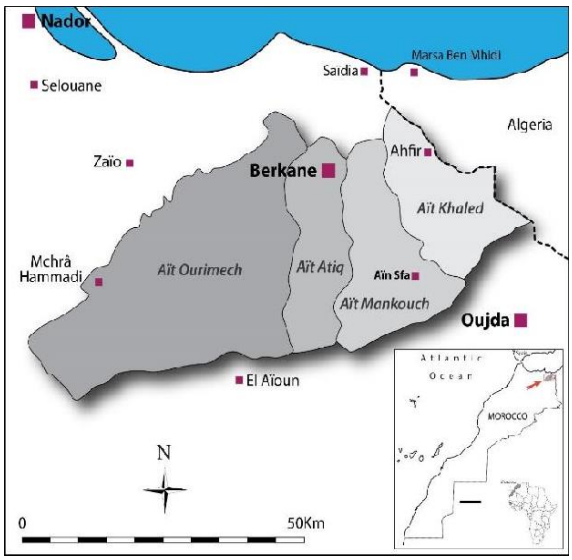


**Figure 2: Borders of the Four tribes in Ain Sfa**

The Beni Snassen Mountain chain [22] [25] is a small limestone chain in the Tellian region of eastern Morocco which owes its name to a Berber Zenite group. It is an asymmetrical single fold of dolomitic limestone whose core is made up of primary shales. The Monts de Béni Snassen, classified SIBE on 6750 ha, are remarkable for the diversity of fauna and flora. They culminate at 1532 m with the Ras Foughal (Fig 3) [5] [6] [23].

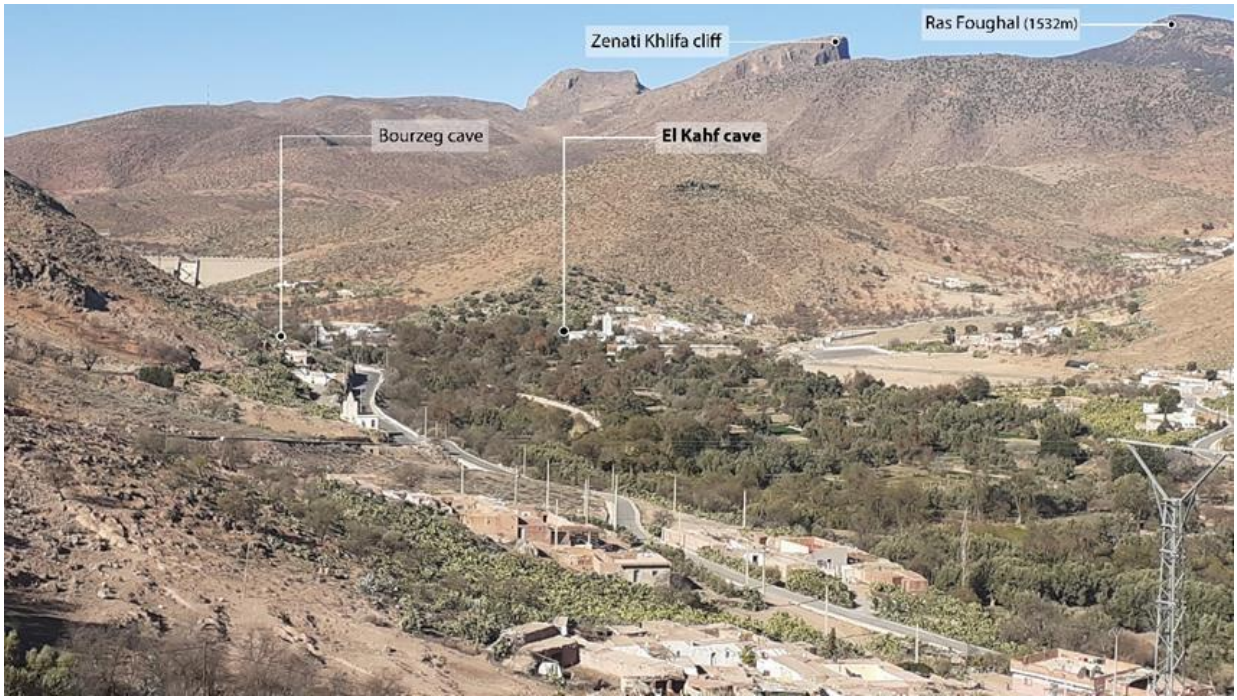


**Figure 3: General view of the El Kaf cave site**

## Materials and Methods

This study adopts a qualitative methodology that is part of an exploratory and comprehensive approach. Two types of data were collected. On the one hand, documents, written, audio, both internal (administrative documents, interview with local residents, documentary and reportage) and external (articles, inventory report) were treated according to the principles of the analysis classic content. Interviews lasting an average of 30 minutes per person were conducted, face to face, allowing this case to be contextualized and the data to be explored [2]. The people interviewed correspond to interest groups, such as professionals from the rural municipality, a hiking association, or even local residents. In order to strictly respect the anonymity required by the respondents, the functions of the respondents are masculinized and made more generic. Consultation and examination of the information available via documents (scientific publications, etc.) and reference websites (regional biodiversity observatories, etc.) making it possible to specify the context of the study site. The visit of the site accompanied by an expert allowing to establish a rapid pre-diagnosis. After taking measurements and photographing, observations of the wall surfaces of the ceiling, floor, and sides of the cave corridor, which allowed us to identify the nature of the Karst [3].

**Results and Discussion**

The litho-structural conditions, associated with the climatic conditions, condition a typical karstic morphology at the different scales of observation. The climate of the community is semi-arid, characterized by cold winters and hot summers. Mediterranean climate with hot summer [21] [22]. The hydraulic system is a compartmentalized system. It includes a drainage network that accumulates water of various origins: stock of water from the epikarst, fillings or even from the ground, as well as rainwater that infiltrates immediately, causing floods [29] [30]. The flow of water from inside the cave to the outside is continuous, with a variable flow depending on the season, sometimes in rainy winters the water rises and completely occupies the volume of the entrance door of the cave (this phenomenon can be zero, once, or twice a year depending on winter rainfall). This makes a cool climate inside the cave in summer, and temperate in winter.

The El Kaf Sefrou cave is located in the rural town of Aïn-Sfa, 30km as the crow flies NW of the city of Oujda in Eastern Morocco. It is open in the calcaro-dolemitic massif of Beni Snassen of Sinemurian age (approximately -199 million years), a formation deposited in a marine platform environment. It opens towards the South-East by a door of 2.43H/2.67L and occupies a panoramic and strategic position dominating the lower valley of Oued Sefrou.

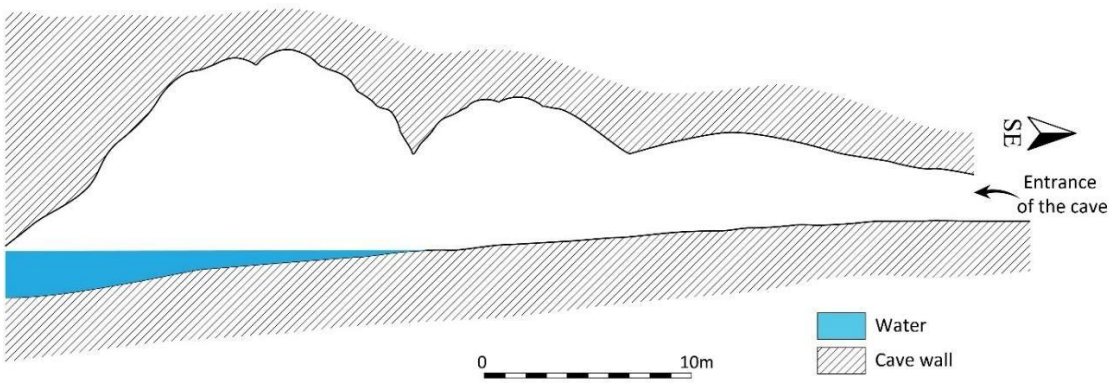


**Figure 4: Longitudinal section of the cave**

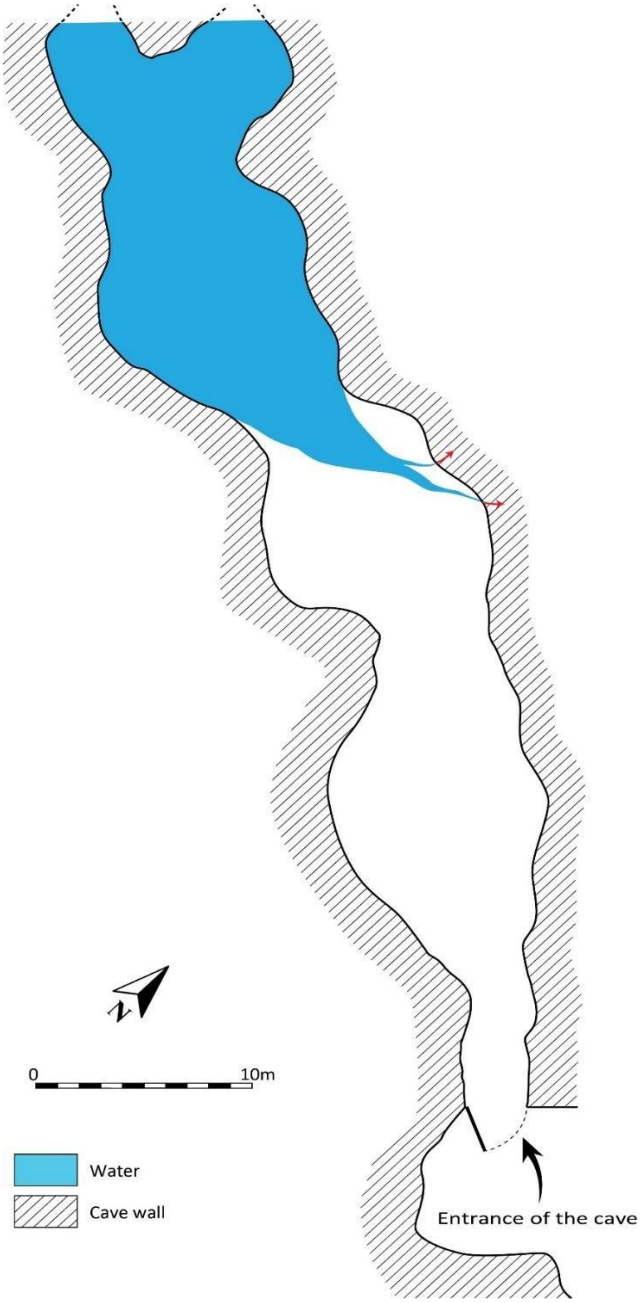


**Figure 5: Longitudinal section of the cave**

The cave has 14 cavities (Fig 6) separated by siphons of different shapes and sizes: the first cavity (Anssara cavity) about 64m long by 13m wide, has a place of Speliotherapy (Lamsalla) in the form of a bed. Good ventilation, easy access and its location in a place overlooking the landscapes of Oued Sefrou, the cave is a place conducive to the development of tourist activities. This hypothesis is also supported by the abundance and variety of fauna, flora and landscapes.

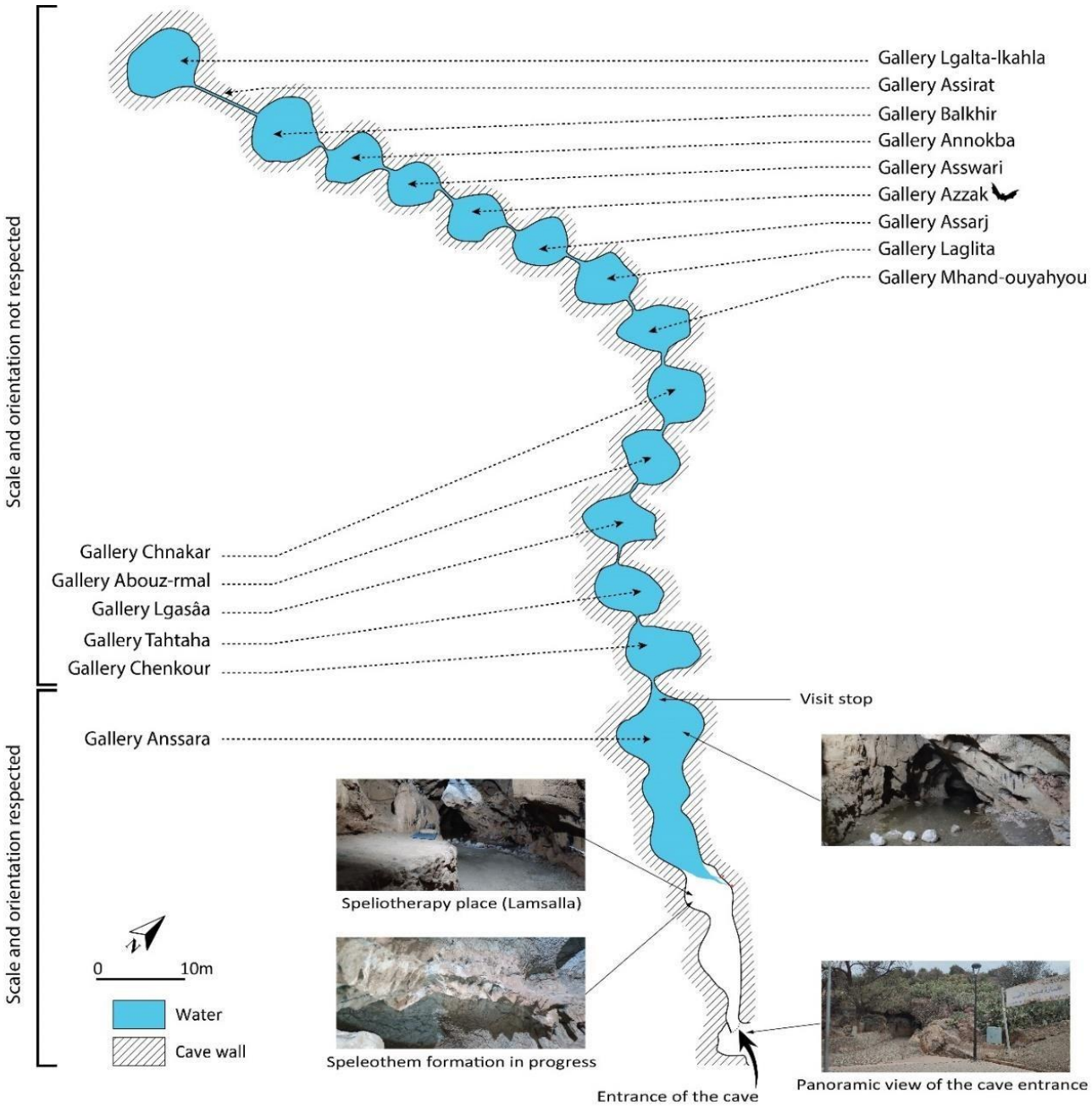


**Figure 6: Longitudinal section of the cave**

**Table 1: Descriptive study of the El Kaf Cave**

| Type of study | Cave Information | | |
|---|---|---|---|
| **Geomorphology** | **Distance from other sites (as the crow flies)** | **Link with other caves in the region** | **Karst formation** |
| | • Pigeons Cave : 23 km<br>• Camel Cave : 19,5 km<br>• Guenfouda Cave : 31 km<br>• Bourzeg Cave : 235 m | • All of these caves are located on the Beni-Snassen massif.<br>• The Monts des Beni-Snassen composed of Small Mountain range<br>• The continuity of the cave in the Béni Snassen massif is undetermined. | • These caves are formed by the phenomenon of Karstification in Jurassic carbonate rocks.<br>• The cave is dug into calcareous-dolomitic rock of the Lower Jurassic age (between 174 and 201 million years), a formation deposited in a shallow marine environment. |
| **Geographical coordinates** | **GPS** | **Lambert Coordinate's** | **Altitude** |
| | • **Longitude** : -2,1543419 ;<br>• **Latitude** : 34,7796259<br>(34° 45′ 8″ North, 2° 8′ 36″ west) | **X**= 796,87 ;<br>**Y**= 468,99 | 640 m above sea level. And opens to the South-East |
| **Interior description** | **Description of existing natural formations inside** | **Corridor of the cave** | **Contrast, vertical development and structuring of space** |
| | • Stalactites which are still active(in training).<br>• Intersecting Marmites (erosion basins) that line the vault of the cave. | • **Number:** 01<br>• **Continuity:** yes<br>• **Length:** more than one km according to the testimony of a person who has explored the cave several times. | • The Entrance and the corridor of the cave has a very gentle slope (no contrast)<br>• Absence of iconic representations, |
| **Tourism and Facilities** | **Infrastructure** | **Visitor Protection and Safety Status** | **Damage and threat** |
| | • **Protective door:** Yes<br>• **Lighting lanes:** Yes<br>• **Cleanliness:** Yes<br>• **Orientation panels:** Yes<br>• **Asphalt road:** Yes<br>• **Security guard:** Yes<br>• **Car parking:** Yes 50 m from the entrance to the cave<br>• **Public toilet:** Exists 30 m away<br>• **Nearby Café-Restaurant:** Exists in the vicinity of the cave.<br>• **National**<br>• **Heritage:** No (communal)<br>• **Classified site:** No | • Provided by the rural municipality of Aïn Sfa.<br>• The site presents no risk (no overhang that could fall).<br>• Cave diving: The risk of toxicity (hyperoxia) is poorly estimated. if the exposure time and depth limits are not respected. | Visitors deteriorate the aesthetic quality of the cave by:<br>• Carvings, paintings and traces of black smoke (caused by candles) left on the inner wall of the cave.<br>• Cracks affecting speleothems (essentially stalactites). |
| | **Visibility** | **Site accessibility** | **Added value of the site** |

| | | | |
|---|---|---|---|
| **Visual identificatio nand observation from the outside** | The cave is only visible from a short distance (not exceeding 50 m) due to the dense vegetation that surrounds it and also to the very low position it occupies in the valley. | • **Easy:** Yes<br>• Accessibility is possible for peoplewith disabilities or reduced mobility. | • **Aesthetic value:** Very good<br>• Economic income from visits goes back to the rural commune of Aïn Sfa.<br>• **Water source:** flow from the interior towards Aïn Bourzeg 100 m from the cave used for irrigation and consumption. |

### ❖ Geological study and Hydrobiology:

Water source in the cave (Fig4 and 5): The water is always present in the cave but infiltrates at the level of the wall, and during rainy periods the water overflows the cave and comes out through the door. Water is commonly associated with caves. Since the oldest traditions, it has taken on a symbolism charged with virtues adopted by religious rituals: Christians and Muslims. Water has a symbolism that can be reduced to three dominant themes: source of life, means of purification and center of regeneration [12]. Water, charged with natural virtues, has also always been closely linked to fertility and fecundity [8].

Morocco has suffered, over the last century, severe droughts with sometimes major impacts on agriculture and the availability of water resources. The difficult episode experienced between 1979 and 1984 by the populations of the Moroccan kingdom led to the development of a project aimed at characterizing and understanding the climatic mechanisms responsible for these phenomena, in order to assess their possible predictability.

Discharge of the source water from the El Kaf cave around 50m then to Aïn Bourzeg from the same distance from the first exit point, with a usual flow of 5L/min

### ❖ Economic Importance and Infrastructure (Tab 1):

The quality of infrastructure is an important cause of the effects of infrastructure on agricultural growth and poverty reduction. Investment in rural infrastructure is capital intensive; low agricultural prices can cast doubt on the study of infrastructure projects. However, without these investments, much of the world will continue to be unable to contribute meaningfully to economic growth.

Group of Idriss I primary school children, two Koranic schools (for boys: 'Abi-Jida Ahmed El Yaznassni school' at the Aïn Sfa center and the other at Tinissane), five means of collective school transport, a rural health center with

two ambulances, an accommodation center for school children (boys and girls) next to a local gendarmerie station, a rural commune administration 'Jamaâa', rural administrative district 'Kayakât', drinking water and electricity connections rural population service, post office and telecommunications network (60005 Aïn Sfa), a souk in the center every Saturday morning, a secondary provincial road P6017, the main mosques, one in the center of the rural commune and the other in Sefrou (30m from the El Kaf cave), an inn in Tinissane (7km from the El Kaf cave as the crow flies), presence of cafes and restaurants on site, presence of a water dam on Oued Sefrou (at 600m from El Kaf Cave as the crow flies ); five cemeteries (one in the center of Aïn Sfa next to the seven domes of Beni Oukil, one of Ouled Ouarrou, one of Ouled Lmansar, one of Ouled Lmalha, one of Ouled Benâini); The marble industry 'Mondial Exploit' and 'SOREVET'; then Crushing 'CO Afrique BITUME' which settles in 'Lamgiäda'

### ❖ Agricultural and animal resources

Agriculture is the first vital economic activity for the population of the community of Aïn Sfa, it is based on agriculture and the breeding of livestock and poultry. It is characterized by the diversity of the products, but it lacks the techniques and methods allowing the availability and the improvement of the production. The estimated number of farmers in the rural community of Aïn Sfa is estimated at 1353 people.

Olive growing of the 'Moroccan Picholine' variety is a fundamental component of the agricultural sector, it is placed at the crossroads of economic, social and environmental issues with multiple intersecting problems, the olive processing sector in Aïn Sfa brings together some traditional units (Maâsras) with an average olive oil production capacity of 150 L/T annually. Almond tree is the most durable fruit tree. However, its production is quickly running out [18].

The first fruit tree to flower at the end of winter, the almond tree adapts well to dry Mediterranean conditions and presents a good opportunity to develop marginal land. With an annual production of 18,000 tons over an area of 34,500 ha in the eastern region of Morocco [10]. In addition to its undeniable economic interest, it is of recognized interest in the development of fragile ecosystems in terms of soil fixation and landscape beautification. The almond products found on the Saturday market are inshell almonds, sweet almonds (shelled), bitter almonds (shelled). The almond tree is used as a fruit tree in the fight against this erosion in situations where the slope exceeds 5% [19].

The breeding of the population of the rural commune is generally

characterized by cattle sheep, goats and poultry, and beekeeping following the production of honey by bees of the black race *'Apis mellifica intermissa'* (Bee Tellienne) characterized by their tendency to swarm, their natural aggressiveness and low productivity [1]. The beekeeping potential in Morocco is significant and yet, today, the beekeeping sector remains under-exploited with stagnating honey production due to many difficulties in repopulating the colonies despite the State's efforts to modernize the beekeeping sector. The so-called traditional Moroccan hives are horizontal type hives, they are made from locally available material: cork chain hives, or wooden hives.

An ecological diagnosis aims to draw up the inventory and understand the functioning of ecosystems to identify all the elements likely to guide the development and management of the space concerned. The evaluation of the functioning of ecosystems and their state is based, above all, on the evaluation of biodiversity and requires, for a given site [33]: Have a list of plant and animal species and habitats present, their distribution; Evaluate the evolution capacities and therefore the adaptation of environments to disturbances; Know the interrelationships with the environments neighboring the site or further afield; Assess the challenges of the site in terms of conservation of the habitats and species present and in terms of the functioning of the ecosystems.

This approach comes up against a number of limitations: The living world is complex and its description difficult both for the species that compose it and for their relationships within ecosystems; Certain groups of species are poorly known (for example certain insects) or require very specialized specialists for their identification; The functioning of ecosystems is not limited to biology but also includes edaphic and climatic factors…

❖ **Culture:**

The cave is the source of several stories, more or less anecdotal, told until today by the inhabitants of the region.

The legends related to the cave of Kaf Aïn Sfa: The cave does not tolerate gold: many people have lost their gold rings or necklaces. The cave has the blessing: the story told

The crowd is large and talkative in the souk where visitors jostle to stock up on goods, on the newly installed public benches where they talk about the weather and the harvests, around the tables of the cafes to sip a mint tea or absinthe.

The isolated caves offering in particular to travelers who made a long journey a shelter against bad weather; the protective deity was then solicited by

a prayer and a sacrifice, either in the hope of continuing the journey in safety, or to thank it after a successful journey. The poor quality of the offerings reveals the low social level of the pilgrims. But certainly, a security problem arose, as there was no guarantee that valuable objects would remain in place in unguarded caves [16].

Stones and waters have always had a sacred aura, bringing into play elements of nature, especially in relation to natural cavities. There are many variants of rituals that involve stones and waters [31]. These rituals are in continuous evolution, some can be born, others grow, some transform or multiply and finally some decline and die.

The reputation of these rituals is often based on their therapeutic virtues and is conveyed by popular networks of followers of different religious communities.

In the so-called traditional society, as could be this mountainous rural region, the social status of women was limited to getting married, no other function was recognized for them outside of marital status. Before the marriage, and for this to be possible, it was necessary to seek out the bridegroom; after the marriage, and for it to be lasting, the husband had to be retained. Also, the woman had to imperatively keep her position of wife and not be supplanted by a rival.

### ❖ Speleotherapy:

It is a method of treatment, using the specific and unique characteristics of the environment, in particular the particles contained in the air of underground spaces, mainly karst caves, in the treatment of chronic and allergic respiratory diseases.

To assess the quality of life, patients who faced caves as a place of accommodation at the time of treatment against respiratory diseases, then compared whether respondents who received a spa treatment accompanied by speleotherapy had a better quality of life. A study carried out in a similar cave of the cave of El Kaf, confirmed a component, the symptoms displaying the frequency and the force of the complaining breaths; cough, shortness of breath, number of seizures and strength at significance level, confirmed that 90.4% of patients treated with speleotherapy showed improved clinical condition [17].

### ❖ Security and tourism:

Damage and threat to the cave: Visitors deteriorate the aesthetic quality of the cave by engravings, paintings and traces of black smoke (caused by candles)

left on the internal wall of the cave; and breaks affecting Speleothems (essentially stalactites). The World Tourism Organization writes that tourism must take full account of its current and future economic, social and environmental impacts, meeting the needs of visitors, professionals, the environment and host communities [26] [27]. The factors that influence the dynamics of the caves as of the entire karst system are of natural origin (precipitation, climate, vegetation, etc.) or anthropogenic, whether on the surface or directly underground (surface logging, direct surface or underground pollution, constructions, facilities, deliberate damage, etc. [28].

The promotion of the tourist economy, a lever of the regional planning policy, mobilizes a series of actors in networks who interact on the basis of a common history. Territorial management "reflects the ability of actors to develop local resources, by exploiting their historical, natural, economic and social dimensions" [6].

❖ **Site Environment, Ecology and Biodiversity (Fauna and Flora):**

The cave is surrounded by a few feet of Carob (*Ceratonia siliqua*), Elm (Ulmus), Atlantic Pistachio (*Pistacia atlantica*) and Almond (*Prunus amygdalus*). It is overworked by olive trees (*Olea europaea*) and prickly pears (*Opuntia ficus-indica*).

The Faunistic surveys are random, even non-existent, concerning the taxonomic groups:

- Mammals: the golden jackal *'Canis aureus'*; Fox ''; Porcupine '*Hystrix cristata'*, hares and rabbits; wild boar *'Sus scrofa barbarus'*; The weasel,
- Birds: Partridges and wild pigeons, Ravens, Falconidae
- Reptiles, Scorpions and snakes, amphibians, non-cavity invertebrates, fungus, lichens.
- Truly freshwater fish living in fresh water, belonging to the fauna of continental waters of Morocco, they are very small in size and play a very important role in water filtration

The food deficit, and the degree of overgrazing result from this situation which reaches 98% degree of overgrazing in Beni Snassen, in a forest area of 68,581ha [7].

Faced with the spectacular development of artificial nocturnal lighting, wildlife, and in particular bats, must deal with a redistribution of access to vital resources (redistribution of food resources influenced by nocturnal lighting, access to corridors and areas refuge and rest sheltered from predators, etc.)

which add additional constraints to the costs of movement of the species, or even limit the resources of the home range [28].

Specific environmental factors are sometimes uncertain, particularly in the case of the ecology of uncommon or recently discovered species. In the same vein, certain species have been considered "limiting" in order to be able to constrain the depositional environments; this approach requires the use of limit values (salinity, pH, etc.) mentioned in the literature which sometimes appear very different for the same species [32].

## Conclusion

The El Kaf cave is of great importance to the Aïn-Sfa commune by its ecotourism wealth, natural, cultural and socioeconomic biodiversity, hence the interest of scientific studies whose results can lead to a morpho geological database and biological, thus allowing a good knowledge of a place to be discovered and to admit it as national and international heritage and to preserve and protect. The source of water it contains gives it an advantageous aspect over other caves in Morocco, it allows the cave a beauty, a fascinating mystery, and an exceptional landscape. As a result, the El Kaf cave is qualified as karst where these rocks have an essentially underground hydrography, consisting of cavities that can be penetrated by man. These conduits lead to often spectacular springs that have been used since antiquity for the water supply. The karst and the processes of its genesis and its evolution constitute aquifers offering interesting resources and reserves to exploit. Its hydrogeological characteristics and its functioning make it possible to understand its specificities in order to better take advantage of them without overexploiting its resources.

Finally, this study has enabled us to discover a tourist heritage of great local and regional importance, hence the need for recognition and protection of the outstanding ecosystem around the El Kaf cave.

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