



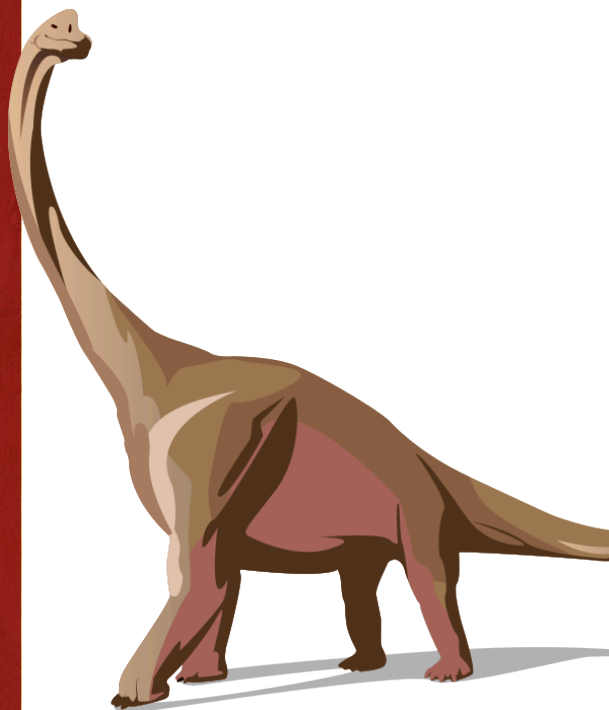
# SUMMARY

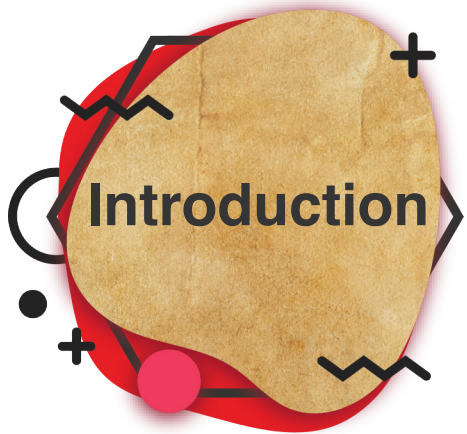
## 3 | Introduction

4	I - PRESENTATION of the GEOPARC
5	HISTORY
6	POPULATION
7	GEOLOGICAL HISTORY
10	WATER RESSOURCES
10	BIODIVERSITY
13	ARCHITECTURE
14	CULTURE
15	ASSOCIATIONS AND COOPERATIVES

## 16 | II- EXCURSION

- 16 Day 1: MARRAKECH – BENI MELLAL via DEMNAT – OZOUD and AÏT ATTAB
- 17 Stop 1 – Amedghouss
- 17 Stop 2 – Demnate and the Center for Education to the Environment
- 19 Stop 3 – Iminifri Natural Bridge
- 21 Stop 4 – Traces of dinosaurs in the basin of Iouaridene
- 22 Stop 5 -Ouzoud Waterfalls
- 27 Stop 6 – The Pass of BeniAyat
- 28 DAY2 :BENI MELLAL - MARRAKECH via AFOURER, BIN EL OUIDANE and AZILAL
- 28 Stop 7 – Ain Asserdoune Water spring
- 29 Stop 8 -Afourer
- 30 Stop 9 - Bin El Ouidane Dam
- 32 Stop 10 - Azilal and its Museum





The area of UNESCO global M'Goun Geopark is one of the important tourism destinations in Morocco, Well known for the beauty of the landscapes and the quality of the hospitality of the inhabitants for the visitors. The accesses to the area of the Geopark are many and easy to attend, between the plain and mountains, but the majority of the sites are located in the high mountains and it need more times and days for a thorough visit.

This booklet guide focuses on the northern

area of the Geopark with information about Geology, Hydrology, History, Biodiversity...of the area, and we will visit multitude sites classified as Geosites of the M'Goun Geopark labeled by UNESCO, in 2 days of a field trip, 150 km far from Marrakesh. Morocco is well known for the academic community as an open space of geology, and that's why geology is filigree of the information about the area of visiting. 2 maps are added, one is a geo-touristic map and, the second is a geologic map of the M'Goun Geopark. We will visit the fabulous natural bridge of Iminifri, a natural reserve for migrator and endemic birds, surrounded by the olives trees as a forest around the valley. Not far from it, we will visit the site of louariden where the traces of the passages of dinosaurs are located, and the city and the old medina of Demnate where an important center for education to the environment is one of the important active NGO is located. The following steps are the famous Ouzoud Waterfall and the fabulous synclinal geological structure of Aït Attab, the city of Azilal where the museum of the M'Goun Geopark is located, the big lake of Bine el-Ouidane Dam and its hydro-electric equipment. The Authors tank all the actors of this event, The BeniMellaWilaya, the Azilal Province, The Regional Council and the M'Goun Geopark Association for them help who made available the necessary means to carry out this work.

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# PRESENTATION of the GEOPARK

The UNESCO Global M'Goun Geopark is located in the middle of the central High Atlas chain. It contains a geological and architectural heritage of great value; their protection and enhancement constitute a vector of geotourism development with very appreciable socio-economic benefits for the local populations.. The M'Goun Geopark covers an area of 5730 km<sup>2</sup>

and includes 15 municipalities. The territory of the M'Goun Geopark covers a medium to high mountain region (between 500 and 3500 m) with a Mediterranean-type climate with Atlantic influences and geological formations belonging to the Triassic, Jurassic and Cretaceous systems. The total population of the Geopark is around 200,000 inhabitants. It is predominantly rural and Amazigh. The populations of the High Atlas of Azilal are linked to a peasant settling and pastoral mountain way of life, showing ancestral traditions which are manifested during their numerous ceremonies by songs and dances.

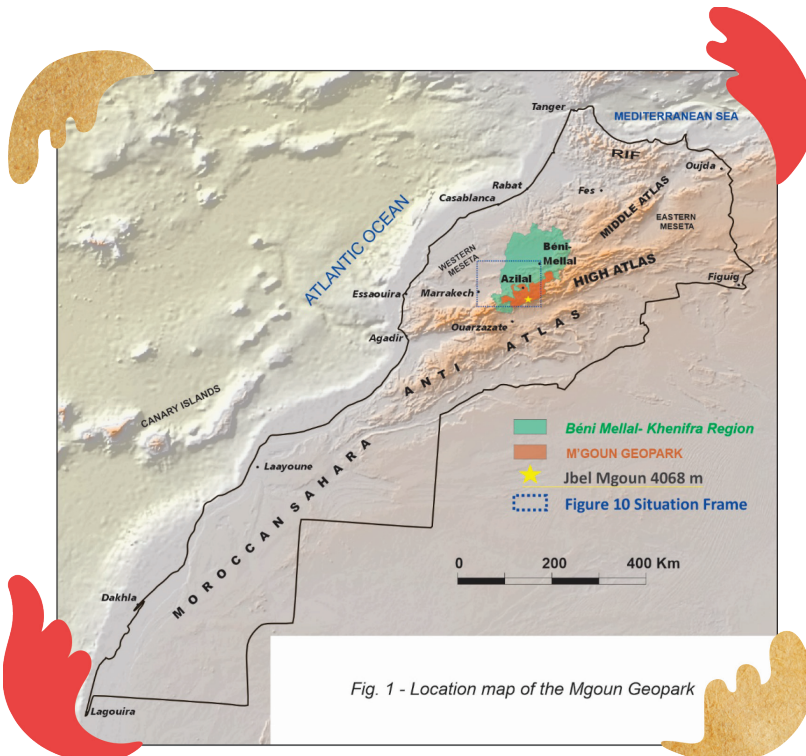


Fig. 1 - Location map of the Mgoun Geopark

The M'Goun Geopark is home to a characteristic and grandiose cultural heritage which continues, despite the phenomena of change in socio-economic structures, to convey historical, anthropological, economic and architectural messages. This wealth is mainly composed of a tangible and intangible heritage whose main elements are manifested in dances, songs, tales, archives, dwellings, collective granaries, sanctuaries, etc. These cultural components are part of a well-defined natural and social environment and reflect the mutual exchange between humans and the environment through in particular an architectural typicality, certainly in crisis, but strongly symbolic: stone and earthen villages, Kasbahs and collective granaries attics. The territory of the M'Goun Geopark is currently experiencing a large number of activities:

- Protection and development of geological and cultural sites;
- Development of local agrifood products (almonds, apples, walnut, olives, honey, saffron, etc.);
- Improvement of tourist reception and infrastructure;
- Support and supervision of local associations and cooperatives;
- Organization of mountain sporting events (trail, kayak, climbing, hiking, etc.);
- Geo-education and awareness of heritage and environmental values;
- Communication, promotion and awareness through brochures, maps, guides, signs, press, website...

## HISTORY

The history of this region of Morocco is so long. The written memory goes back to the period of ancient Greece with its deity "Atlas" which the ancient Greeks imagined supporting the sky with its horns. Locally, in the heart of the territory of the M'Goun Geopark, at the foot of Mount Ghat, rock engravings over 4000 years old (bronze period) attest to the ancient human presence in the high mountain valleys. A Proof that the Atlas Mountains from the ancient times were an important economic place for human life, and an important place for the political evolution in Morocco during his long history. Mastering the passes on both sides of the Atlas means contact with the Saharan oasis and the southern desert, and the northern plains, the two sides of a prosperous commercial past, known as trans-Saharan trade, between the Mediterranean and the southern shores of the great African Sahara, linked to products from the savannah and tropical Africa. Until the end of the 19th century, caravans continued to frequent the cities of Demante, Marrakech or Fez from the Sahara and from the Atlantic and Mediterranean ports. All major cities located at the foot of the Atlas Mountains; on either side North or South signifies the importance of the history of the Atlas Mountains located at the heart of geography and history, trade and agriculture, arts and crop production.

## POPULATION

The inhabitants of the High Atlas are mostly Amazigh or Berbers. The Amazigh, known as «free humans», are the oldest known inhabitants of North Africa. The language and the cultural diversity and specificity are the most distinctive features of this ancient people, both Mediterranean and African. The High Atlas Mountains have remained an area of safeguard of the old times Amazigh cultures, which has managed to preserve the use of the Amazigh language and the ancestral culture of its inhabitants. The Amazigh goes back several millennia ago; they participated in the Neolithic revolution around 6000 BC. AD Proto-history promises to be the age of metals attested by the bronze archaeological finds illustrated on the many rock engravings dating back to 4000 years of the Bronze Age, which reveal a profusion of forms and representations that continue to adorn current Amazigh cultural productions. It can be noted that it is in Morocco, in Jbel Irhoud, that the oldest remains of Homo sapiens in the world were discovered in June 2017, dating back more than 300,000 years. The Amazigh are known throughout history by supporting and struggling with the different waves of entries into the territory: Phoenicians (11th century BC), Carthaginians (6th century BC) -, Romans (2nd century BC), Vandals (533), Arabs (711), Portuguese (1415) French and Spaniards (1912). The religions adopted were Jewish, Christian and then Muslim. The current populations of the High Atlas are distinguished by a culture illustrated in the language, particularly Amazigh, customs, furniture, food, festivals, traditions and social relations.

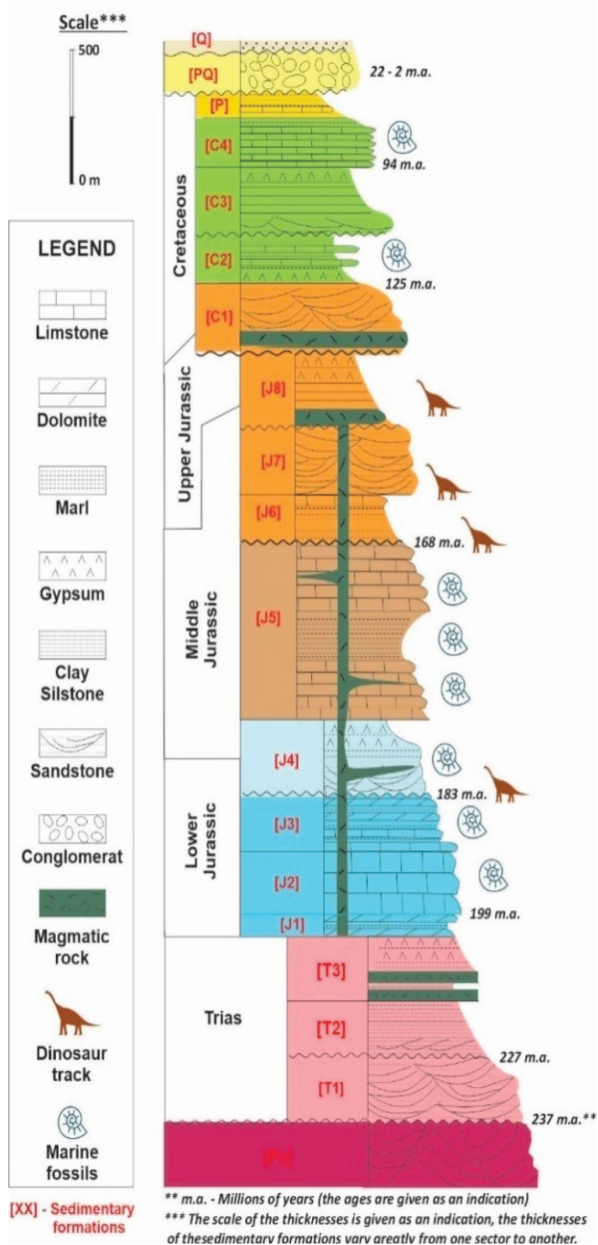


Rock Engravings,  
Tizi-n-Tighist  
(Géoparc M'Goun)

## GEOLOGICAL HISTORY

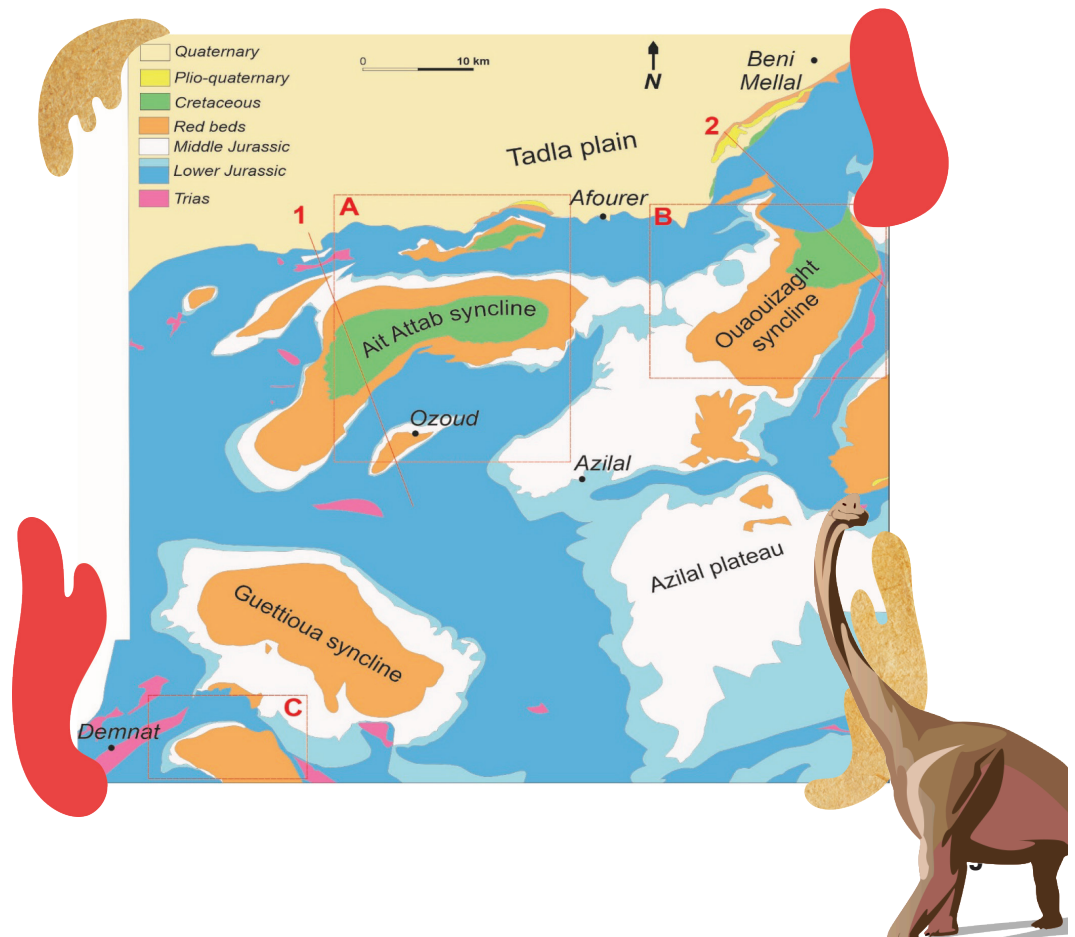
The M'Goun Geopark occupies the heart of the central High Atlas. The rocks of this vast territory are the result of long phases of sedimentation at the level of the borders of the Tethys oceans in the Jurassic and then the Atlantic in the Cretaceous. Above a deformed Hercynian basement [Pz] (fig. 2), the first continental deposits are sandstone and evaporates from the Triassic [T1-3] (-220 million years). The basaltic flows which cover them indicate large tears in the earth's crust responsible for the collapse of the axis of the High Atlas basin which will receive future sedimentation during the Jurassic and Cretaceous eras. In the Lower and Middle Jurassic (-200 to -165 million years ago), the Tethys occupied large areas between Africa and Europe, flooding the borders. The warm waters of this sea advance westward and deposit large amounts of sedimentary layers at the bottom of the Atlas Gulf. Fluctuations in sea level as well as tectonic pulsations at the bottom of the basin are responsible for the wide variety of sediments present [J1-5]. It was during this period that the diapiric activities of Triassic salt contribute to the development of the main anticlinal ridges in the heart of the High Atlas domain. Great changes will occur at the end of the Middle Jurassic. The Tethys retreats towards the east, gradually giving way to continental sedimentation in a hot and humid climatic context, which will give the characteristic red color of the layers then deposited [J6-7-8, C1]: this is the period proliferation of dinosaurs. This stage will last until the Lower Cretaceous (-125 my) and will be characterized by tectonic instability marked by the development of several magmatic phases and by deformations responsible for the outline of the first Atlas reliefs.

*Engravings showing warriors riding horses with spears and shields showing combat and hunting scenes, engraved on Trias sandstone, 3 500 to 4 000 years ago (Bronze-Age). This rock carving iconography is a characteristic feature of the High Atlas. It is perceived as an exceptional archive for documenting, over the last four millennia, the relationships between three main objects that are now integrated in the concept of agdal: the pastoral resources, the modalities of use and ownership (power, territory) and the ritualistic, ideological and symbolic systems.*



**Fig 2: Stratigraphic column of the M'Goun Geopark**

During the Cretaceous period, the territory of the M'Goun Geopark occupied a border position with respect to the nascent Atlantic Ocean. Two phases of marine transgressions will flood this territory [Aptian - C2] and [Cenomanian-Turonian-C4] and mark the end of its marine history. The Tertiary era marks the birth and then the development of the current mountain range. The coming together in a south-north direction between Africa and Europe, controlled by the global phenomenon of plate tectonics, will be responsible for gripping the Upper Atlas basin between the rigid territories to the north (Mesetas plateau) and to the south (Saharian craton). This compression will give rise to sets of folds and breaks (fig. 3) which will be lifted and then attacked by erosion, whose deposits (conglomerates and pebbles) will build large rock masses at the bottom of the hollows of the folds (conglomerates of the Cathedral [PQ]). The continuation of this evolution will take place during the Quaternary era. The generalized raising of the chain will favor the shaping of the contrasting relief which gives the current landscape of this territory all its splendor (digging of deep gorges, setting up of long valleys with flat bottom and narrow and raised borders, perched karst plateau, waterfalls...).



## **WATER RESSOURCES**

The M’Goun Geopark constitutes an immense karstic water reservoir, it is crossed by many rivers or Wad or Asif (Oued El Abid, Melloul, Ahansal, Lakhdar, etc.) which drain the region and descend to the West towards the plains of Tadla by flowing into Oued Oum Rbéa. In the area of the Geopark, we have three Dams reservoirs, known among the most numerous in Morocco, they constitute permanent lakes: (Bin El Ouidane and Ait Ouarda on Wad El Abid ; Hassan 1st – known as Tachouarit - on Wad Lakhdar).

## **BIODIVERSITY**

The flora of the M’Goun Geopark territory reflects the Mediterranean bioclimatic layering and offers a succession of numerous natural and agricultural landscapes. The dominant olive tree in the region corresponds to a culture linked to water and coupled with the production of vegetables, fruits and fodder. Open and uncultivated spaces are linked to cereal farming or grazing. Other spaces in dry areas are linked to almond trees; the region is one of the main producers in Morocco of almonds, olive oil, nuts, honey, cereals and sheep. In the plain of Tadla, thanks to the Bin el Ouidane Dam, modern agriculture is promoted for the production of oranges mainly, with other goods such as milk, cows, sugar beets and vegetables. With the altitude, the forest occupies an important space and place in the geographical system. A Mediterranean type wood, but very diversified, because in the heart of the Middle Atlas there is an important forest of cedars in the world (*Cedrus atlantica*). On the side of the territory of the geopark the cedar disappears and other varieties occupy the arena. Oak, holm oak, pine, juniper, jujubes, cedar, carob, laurel, peony, spurge, dwarf palms and other

small plants make up the majority of the trees we see in the visiting area. This territory was a prosperous area for a variety of fauna such as lions and panthers which are permanently extinct in favor of jackals, foxes and monkeys which share these natural spaces with other large or small animals and birds, including birds. migrants who transit according to the seasons between Africa and Europe.



**Panther (extinct)**



**Magot monkey**

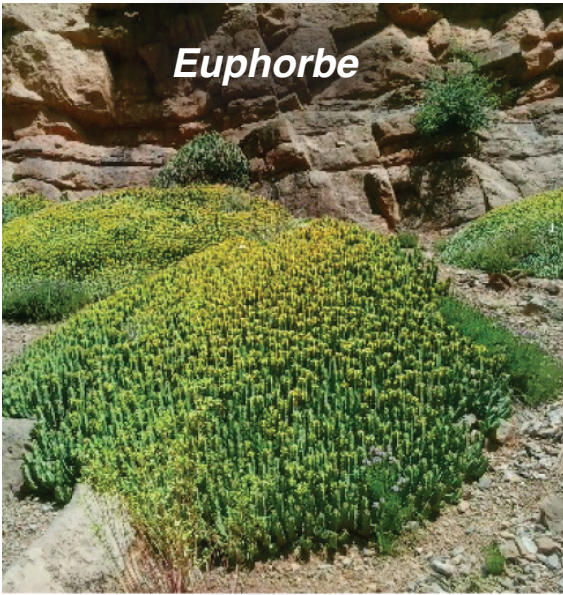


**bearded  
gypsy**

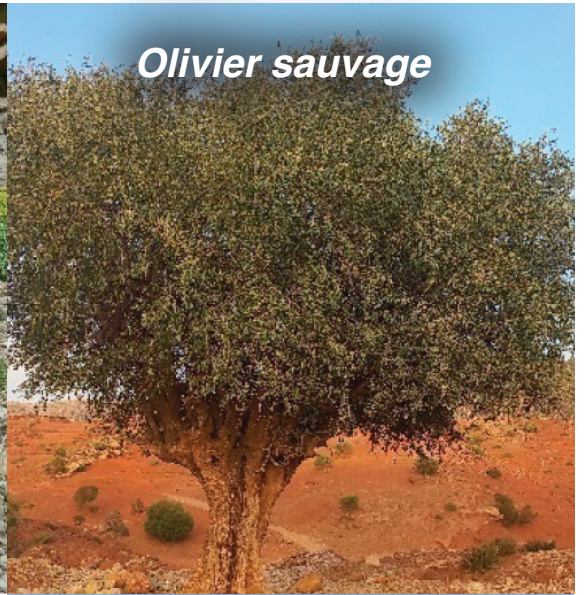


**wolf jackal**

**Fig 4– Some examples of  
fauna specimens from the  
M'Goun Geopark**



*Euphorbe*



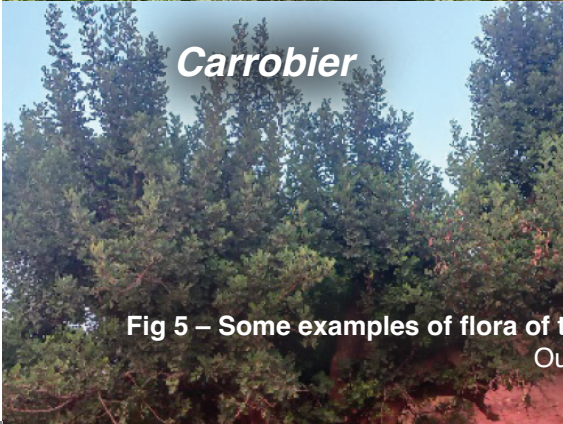
*Olivier sauvage*



*Thuja*



*Juniper thurifera*



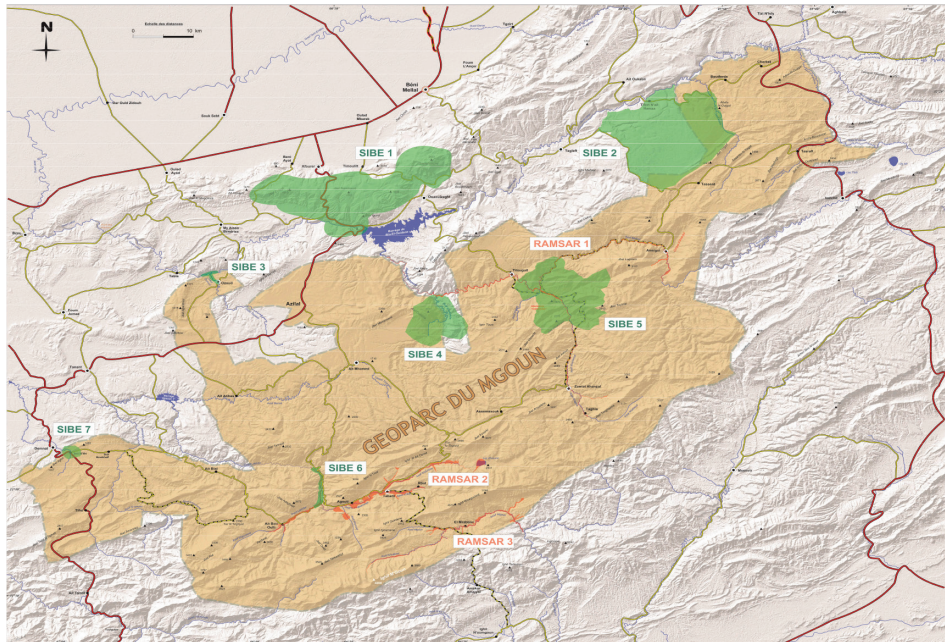
*Carrobier*



*Pine conifer*

Fig 5 – Some examples of flora of the M'Goun Geopark (Photos by B. Naït Ouacha)

The sites of biological and ecological interest (SIBE) recognized by the administration of Water and Forests in the territory of the Geopark MGoun are 5 sites: (Ouzoud, Iminlfri, wad lakhdar, Tamga and Aqqa ouabzaza). The RAMSAR sites (international Ramsar convention) focused on the conservation and rational use of wetlands and their resources recognized in the territory are 3 sites: Ahansal-Melloul, High Wad Lakhdar and Asif MGoun.



## ARCHITECTURE

The exceptional earthen or stone architectures of the M'Goun Geopark area are essential components of the regional heritage and constitute a pole of major tourist attraction architectural heritage, composed in particular of simple houses, fortified houses (Kasbah), collective granaries (Ighrem). It testifies the great skills in the design and construction technique of architecture with use of clay, adobe and stone which is perfectly adapted with the available material for building, to the type of climate that prevails in this mountainous area, with the landscape, and the environment and the socio-economic characteristics of the population in concern.



**Fig. -7 The Happy Valley of Ait Bouguemmez**

## **CULTURE**

The populations of the High Atlas are linked to a peasant and pastoral mountain way of life, showing ancestral traditions which are manifested during their numerous ceremonies by songs and dances. The tribes of the territory of the M'Goun Geopark have been able to preserve until today the old songs and musical rhythms and dances (Ahidous and Ahouach) specific to each tribe (Ait Bouguemmez, Ait Abbas, Ait Bou Oulli, Tanaghmelt...)



**Fig 8 - Famous local music band of Bou Ghanim (Bougmmaz)**

## ASSOCIATIONS AND COOPERATIVES

The Geopark M'Goun has established a partnership approach for the enhancement, support and development of NGO's and cooperatives operating in the production and promotion of local products, tourism, crafts, mountain sports, sustainable environment... as an effective tool for development, the fight against poverty and opening up.

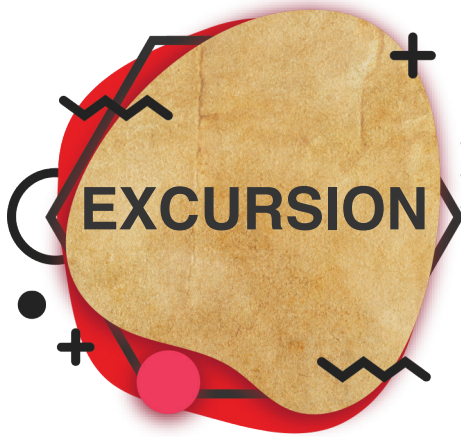


Saffron Harvest



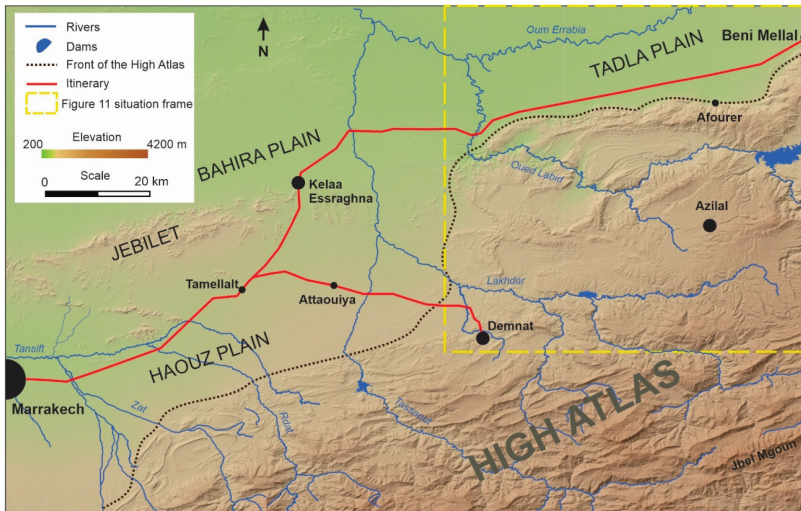
Semi Marthon of Azilal

Fig 9 –Examples of association and sporting activities



## Day 1: MARRAKECH – BENI MELLAL via DEM NAT – OZOU D and AÏ T ATTAB

Leaving from Marrakech, the area crossed towards the North-East (fig. 10) corresponds to the Quaternary alluvial plain of Haouz, a flat territory, broken by a few outcrops of ancient rocks of Paleozoic age. Along the route, the landscape on the right is marked by the majestic chain of the High Atlas, many of the peaks observed here culminating at more than 3000 meters. To the left, to the north, the Haouz plain is bordered by the Jebilet massif (small mountains in Arabic). It is an ancient mountain range formed by land of Paleozoic age.



**Figure 10 - Itinerary to M'GounGeoparc from Marrakech**

This plain is drained by the Tensift River and its tributaries coming from the High Atlas (Zat, Rdat Rivers., cf fig.10); it offers, in its natural state the appearance of an arid steppe dotted with a few irrigation perimeters which allow the cultivation of cereals and the development of olive orchards. From the locality of Tamellalt, the road branches off towards the east towards the town of Demnate. The region of El Attaouia crossed is famous for its many olive plantations developed thanks to hydro-agricultural developments on the Tassaout river and its Dam named Moulay Yousef at Ait Adel.

## Stop 1 - Amadghouss

We are here at one of the many gateways to the M’Goun Geopark. The stop at this level will allow participants to refresh themselves and attend a general presentation on the M’Goun Geopark. The road to the town of Demnate, the subject of our second stop (fig. 11), is carried out in medium uphill conditions. Here too we can appreciate the richness of the cultures of the region, in particular in almond and olive trees.

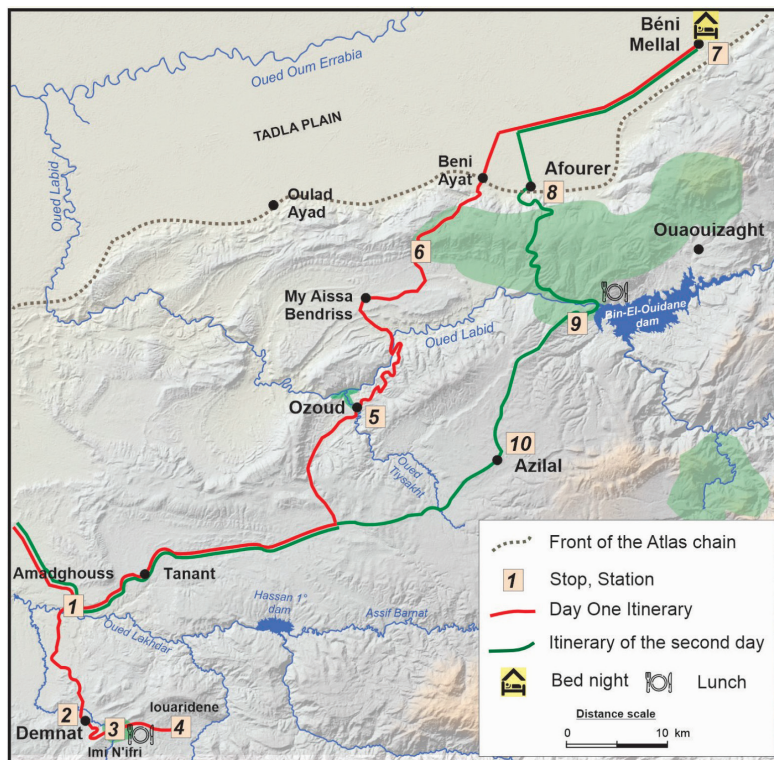


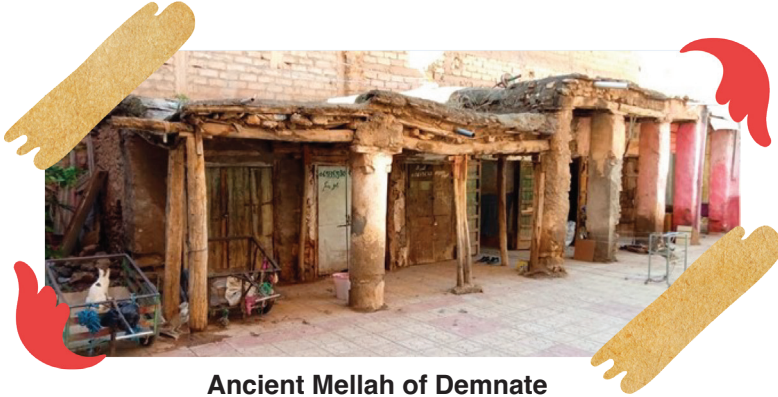
Figure 11 – Excursion itinerary

## Stop 2 :Demnate and the Center for Education to the Environment

Demnate is one of the oldest towns/medina in Morocco, located 100 km northeast of Marrakech, in the heart of the mountains. The documentary resources mention the name of the City under the second Moorish Empire, the Almohades. And from that time, each dynasty gave an important place to the governors of the city, a key place for a large part of the two

slopes of the central High Atlas. A town of trade, commerce and agriculture, Demante was and remains a prosperous town and a crossroads for the inhabitants of the high mountains for their daily and administrative affairs.

*MELLAH of DEMNATE (artisans workshops)*



**Ancient Mellah of Demnate**

*Demante is well known in the past as a town where the Jewish population lived in great harmony with the Muslim population. The Mellah of Demnate or the Jewish residential quarter was built in 1886, and before that, the Jewish population lived in a mixed neighborhood with the Muslims of the old times of the city, close to the Casbah or the Governor's Square of the city state.*

The environmental and sustainable development education activities are hold by the Association of Teachers of Earth and Life Sciences at (AESVT), who founded an educational space for young people to learn about education and awareness actions to the environment (geo-education). The center's museum is focused on promoting the natural, biological, historical and cultural heritage of the area of Demnate.



**Fig. 12 - Museum of Demnate run by the association of teachers of Life and Earth**

### Stop 3 – Iminifri Natural Bridge

The Iminifri bridge is a natural arch over a narrow valley carved out of Lower Jurassic limestone (-180 Ma) by the Tissint river.

The natural bridge results from the precipitation of spring waters rich in dissolved calcium carbonates which are at the origin of the recent Quaternary travertine (-0.5 million years) forming the bridge and its facades (Fig. 13).

This site contains a particular biodiversity (fauna and flora) classified as a Site of Biological and Ecological Interest (SIBE), a spectacular flock of sedentary and migratory birds take shelter under its arch. About 92 species are listed there, among the emblematic species which make it a point of attraction for ornithologists: the peregrine falcon, the white-bellied swift, the lesser kestrel and the red-billed chough.



Fig. 13 :Iminifri Natural Bridge

From this bridge, an aqueduct probably from the 16th century still exists as a testimony to the know-how in agriculture and the use of water resources and the engineering of the bridges. Demnate like Marrakech and Beni Mellal are surrounded by orchards and plantations of olive trees and several other fruit trees with vegetable plantations, thanks to this water that peasants have domesticated since antiquity, using many different techniques to water the fields by complex irrigation systems and organizational codes preventing any conflict. In the direction of the Louaridenes basin, the landscapes are marked by the appearance of well-developed euphorbia on the exposed slopes. The style of housing will also change; the constructions are either in dry stone or in ochre-colored clay with a style specific to the region.



**Sidi Moussa granary attic**

### **KSAR and COLLECTIVE ATTIC**

*During the travel we will see much different type of rural and urban housing styles. The rural areas offer a curious space to observe the inhabitants style in small agglomeration or dispatched. We will see the famous and curious big houses built by adobe, called Ighrem or Kasbah, old important local families castles built with adobe and stones, sign of richness, power and the importance of the place in the past history. Some of this construction is used as granary or the place to hold precious goods and food in a secure place. Sometimes, tribes built granaries in the cliffs, curious challenge for the builders to fit geology with the importance of the security, safety and accessibility. The area of the Geopark M'Goun is very rich of this kind of construction, located everywhere, in high mountains as in the low mountains.*

#### Stop 4 - Traces of dinosaurs in the basin of Iouaridene

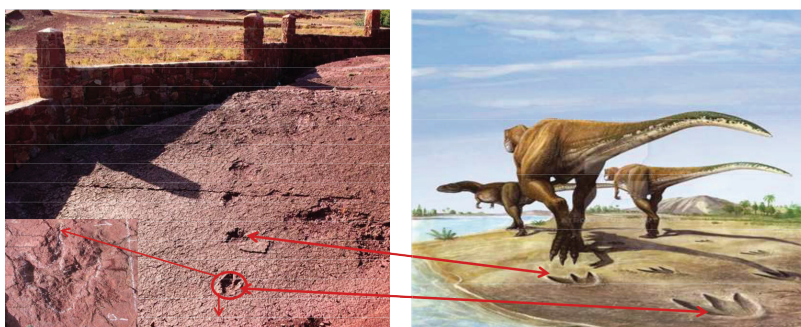
The Iouaridene synclinal basin contains several types of well-preserved dinosaur tracks and footsteps imprinted in red layers from the Middle to Upper Jurassic (-160 million years). The majority of dinosaur footprints are imprinted on hardened, desiccated and cracked surfaces. The sedimentary characters with desiccation figures indicate a river-deltaic continental environment, with temporary emersions, favorable to the development of dinosaurs. (Fig. 14). The footprints of these dinosaurs, some ichno-species of which are local, constitute an international paleontological heritage that must be protected, preserved and enhanced.



*Sequences in sediments showing phases of inundation and emersion*

*Paleo-environnement*

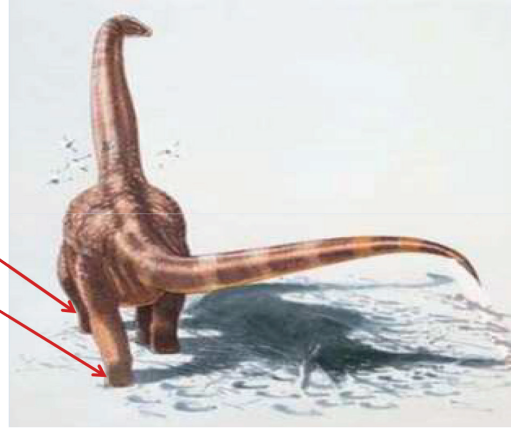
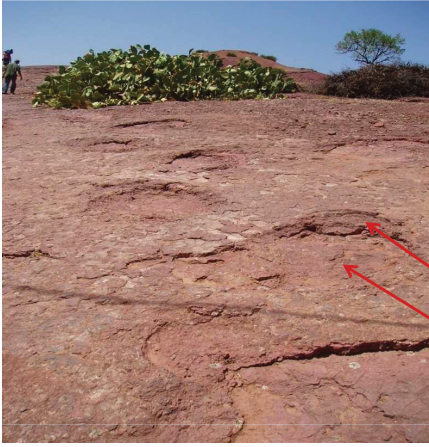
**Fig. 14 : Synclinal basin of Iouaridene, current and ancient landscape**



**Megalosauripus**

*Ichnofossil represented by tracks and three-fingerprints in an elongated shape measuring on average 30 cm in length and 25 cm in width, with three jointed, pointed and separated fingers. A bipedal theropod dinosaur with an average size of 1.5 to 2 meters, abundant in several regions (Portugal, Spain, America, Morocco...)* which were very close during the Jurassic eras.

*Age: Middle to Upper Jurassic (160- million years)*

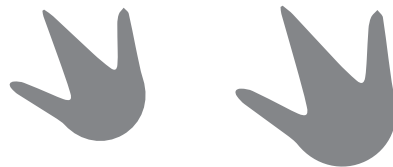
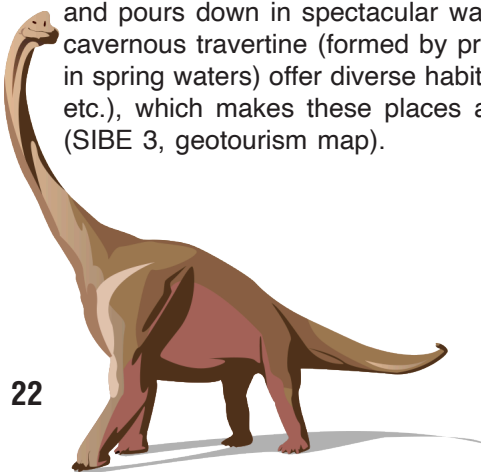


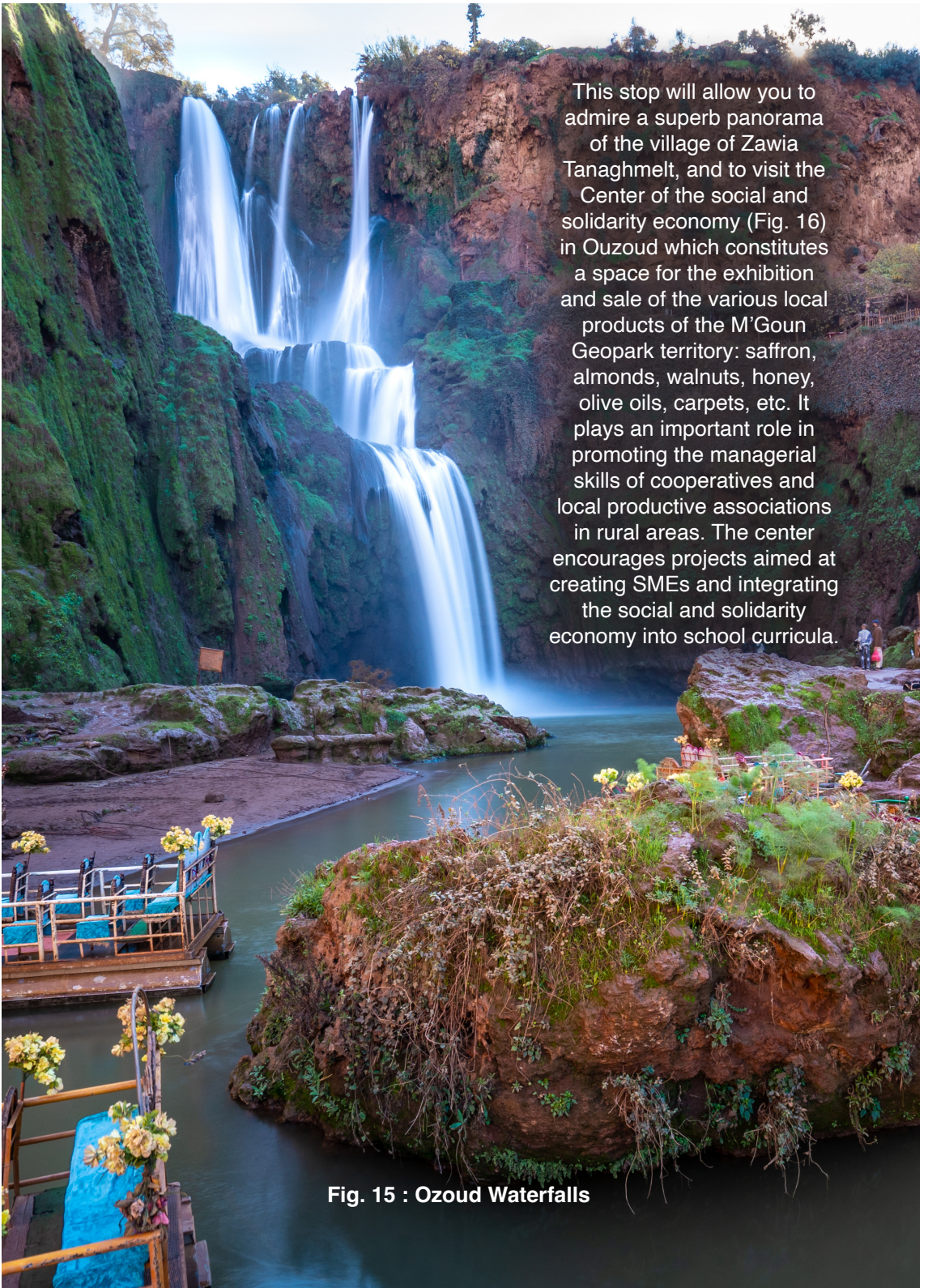
### **Breviparopus taghbaloutensis**

*One of the largest dinosaurs that walked the earth was discovered in Taghbalout and named Breviparopus taghbaloutensis. It is a giant sauropod that has left its footprints along a 90 m track, whose footprints reach record sizes (up to 1.15 m in diameter). The reconstruction of this large animal (close to Brachiosaurus) gives it a height of 20 meters, a length of 30 m and a weight of 50 tons. Age: Middle to Upper Jurassic (160- million years).*

### **Stop 5 – Ozoud Waterfalls**

The Ozoud waterfalls are recognized as an important tourist spot nationally and internationally. The spring waters upstream form the Oued Tissakht which flows over red sediments from the Middle to Upper Jurassic (Iouaridene Formation) and pours down in spectacular waterfalls over a drop of 110 m (fig. 15). The cavernous travertine (formed by precipitation of calcium carbonates contained in spring waters) offer diverse habitats for fauna (maggot monkeys, bats, birds, etc.), which makes these places a Site of Biological Interest and Ecological (SIBE 3, geotourism map).





This stop will allow you to admire a superb panorama of the village of Zawia Tanaghmelt, and to visit the Center of the social and solidarity economy (Fig. 16) in Ouzoud which constitutes a space for the exhibition and sale of the various local products of the M'Goun Geopark territory: saffron, almonds, walnuts, honey, olive oils, carpets, etc. It plays an important role in promoting the managerial skills of cooperatives and local productive associations in rural areas. The center encourages projects aimed at creating SMEs and integrating the social and solidarity economy into school curricula.

**Fig. 15 : Ozoud Waterfalls**



### VILLAGE OF TANAGHMELT

*Ouzoud waterfalls is an important national and international tourism places. In its area close to the place, an important religious and suffi lodge is located in the village of Tanaghmelt. A smart village with his architecture of housing built with adobe, a local ancestor's technique for building strong houses adapted to the climate and topography. The lodge of Tanaghmelt village is founded in the 17th century by a holy person who came from Ait Bougmez valley, one of the highest valleys in the Central High Atlas. The importance of this lodge is linked to the tribes of the area, with the training of religious persons appointed in tribes mosques, and the lodge played a key roles in making peace between tribes and to advice annual meeting in regards of the holly persons buried in the area.*



**Fig 16 : Local products in the social and solidarity economy center of Ouzoud**

The outlet on the valley of Aït Attab offers a view of the splendid landscape of the cuestas shaped in the red layers and the yellow marly limestone of the Cretaceous of the southern flank of this syncline structure. We note here a great development of black basaltic rocks intercalated within the red layers (Fig. 17).



**Fig 17 :Panorama on the northern slope of the Aït Attab syncline**  
*([J3] to [C4] see geological time scale in fig. 2)*

The hairpin descent ends at Oued el Abid River, which we cross on a metal bridge. This river traces in this area a route unsuited to the topography since it can be seen to fork abruptly in a southerly direction to dig deep gorges in the massive limestone of the Lower Jurassic. We then begin a slight climb crossing the series of basalts, red layers and Cretaceous to reach the locality of Moulay Aissa Ben driss located at the heart of the Aït Attab syncline.





### MOULAY AISSA BENDRISS

*Moulay Aissa Ben Driss at Ait Attab is the son of the king Driss the second, the founder of the city of Fes around 789. Moulay Aissa ben Driss was the governor in the area appointed by his father, he died and buried in the land of Ait Attab tribe, giving his name to the village where people are living by doing agriculture, arboriculture and sheep breeding. His shrine is actually one of the important places of meeting, and every year, during spring, tribes of the mountains and plains meet in a Moussem organized in the honor of the holy person, to pay homage to one of the ancestors of the current Alawi dynasty. In the same time, tribe's men and women take the opportunity to make commerce, to renew the pacts of alliances, and to make peace by solving problems. The Moussem is also an opportunity to enjoy festivities with presence of musicians, dances groups and to enjoy one of the famous Moroccan spectacles called the Tbourida or fantasia. Tbourida is registered by UNESCO as an immaterial heritage regarding its specific aspect of this equestrian art. It is a unique spectacle done by riders and their horses, crossing like doing charges as it was in wars during the past. The famous French painter, Delacroix who invented Orientalism in painting, who visited Morocco on 1832 immortalizes this art in many of his paintings, and he was the first who called it Fantasia.*

This area is located at the end of the Atlas Mountains and overlooks the plains. It is a path between the two capitals, Marrakech and Fez, and we know thanks to the documents that, during all the dynasties, the sultans (Kings) moved regularly from one capital to another. Before leaving the mountains, the river was so strong to cross it in the spring, and one of the sultans built a bridge called the Laatomna bridge (see the location on the geo-tourist map), indicating that the ancient way between the two capitals is linked to the passes and the bridge is and remains an important indicator for many subjects, such as the art of

construction, architecture, modernity and the legs of the past, in the history of the construction of technology. The bridge also shows us the importance of this area as a transit hub for caravans and populations between the high mountains and the plain, including the shepherds who historically moved between the two areas in winter and summer. Morocco is well known for its production of herds linked to the leather industry, well known as Maroquinerie, a specialty derived from the old Moroccan tradition of manufacturing the specific art of leather making.

## Stop 6 – The Pass of Beni Ayat

The stop is located just at the mouth of the pass, at the level of a landscaped area offering a superb panorama of the Ait Attab valley (Geosite n° 2, see geotourism map).

In terms of biodiversity, this site is part of the western zone of the SIBE of Jbel Tazerkount (SIBE 1 in the geotourism map). On the geological level, the panorama to the south offers a wide view of the emblematic syncline of the Ait Attab. The succession of geological formations present testifies to a good part of the geological history of this northern edge of the Atlas chain (fig. 18).



**Fig 18 :Panorama on the northern slope of the Aït Attab syncline**  
*([J3] to [C4] see geological time scale in fig. 2)*

After crossing the pass, the descent is slow towards the plain of Tadla through the corridor of Aïtmelloul, rich in olive orchards. By joining the national 8 route, the road takes a rectilinear pace towards the city of BeniMellal which we will reach towards the end of the day.

BeniMellal is the supreme administrative place of the region, the administrative place of the Wali (the governor of the region) and the seat of the Council of the Region elected by the population. The place of the representing of the State, and the representing of the population thanks to election, periodically organized in the region of Beni Mellal-Khenifra, as other twelve other administrative regions, in the context of advanced regionalism consecrated by the Constitution. The two

Institutions are mostly implicated in the M'Goun Geopark Project, and played a key role from the beginning of the idea to promote and to concertize the project. Beni Mellal is located between many contact points between the high Atlas and the Middle Atlas and the plain of Tadla. Again, geography decides for the place, and regarding the strategic position of the city, we know thanks to the documents that it is one of the oldest places of inhabitants settling, playing a key role in trade commerce and human urban activities during the previous history periods.

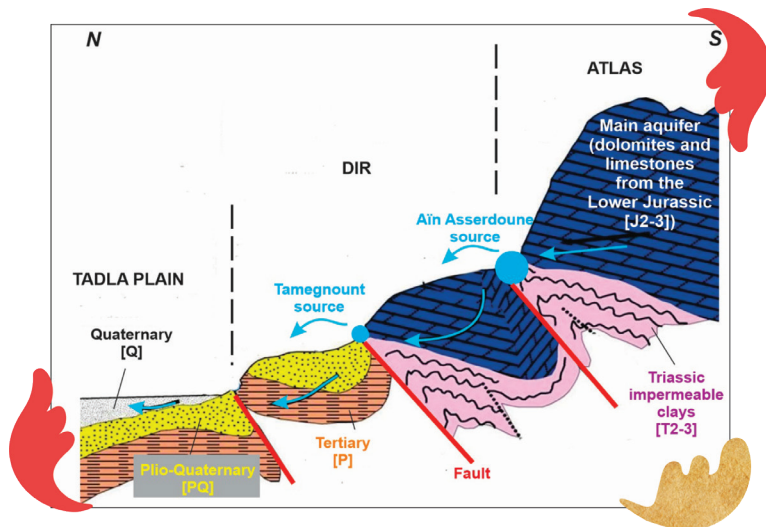
## **Day 2 : BENI MELLAL – MARRAKECH via AFOURER, BIN EL OUIDANE & AZILAL**

### **Stop 7 – Ain Asserdoune Water spring**

The city of Beni Mellal is surrounded by a forest of Olive trees irrigated by water coming from Ain Aserdoune, important water spring canalized to irrigate the bottom around the city. Ain Aserdoune is dominated by an old castle, called Casbah or Borj, was probably built in the end of the 17th, meaning the importance of the place as a guard tower to assure security and watch around.

The border zone of the Atlas constitutes an important karstic system developed in the limestone and dolomites of the Lower and Middle Lias. This karstic system feeds a set of springs that flow along the alignment of overlapping faults limiting the Atlas chain to the north, all along the foothills -Dir- (fig.19). The most important of them, Aïn Asserdoune water spring, has a flow rate of 1100 to 1500 l/s depending on the season. Part of the water that gushes out at temperatures of around 15.5°C is used to supply part of the city of BeniMellal with drinking water, while the other part is channeled to irrigate the orchards of the region. The sharing of irrigation water is done according to ancestral tribal rules. This space currently heavily anthropized and developed constitutes with the Ksar which dominates it an emblem for the city of Beni Mellal and its region.

This stop will allow us to visit the water source, with its landscaped green spaces and to admire the landscape of the city of Beni Mellal and its environment from



**Fig. 19 – Organization of the hydrogeological system of the Dir of Beni Mellal**

(Adapted from Bouchaou & al., 1997) – [T2] to [Q]  
see geological time scale in fig. 2)

To reach the next stop, we leave Beni Mellal to the west by the road to Marrakech (N8). The journey is made at the level of the green plain of Tadla, rich in particular by citrus groves. The northern slope of the Atlas chain marks the landscape on the left.

**Stop 8 – Afourer.**

The first stop is at the belvedere overlooking Afourer. The stop offers a panorama of the Tadla plain, its various hydroelectric facilities and the morpho-structural relationships between the Atlas and the plain. The entire plain is irrigated from an underground water pipe coming from the Bin El Ouidane dam. The tunnel exceeds 10 km in length and crosses the entire Jurassic series of the sector. The landscape here shows the juxtaposition of the following three areas:

- The first foothills of the Atlas that we

have just left sculpted in the limestone and dolomites of the lower lias. They correspond to a faulted and deformed massif, overlapping towards the north thanks to a deep tectonic accident. The altitude of this massif goes from 1500 m at the level of Beni Ayat to more than 2000 m at the level of Jbel Ghnim which dominates the city of Beni Mellal. This difference in altitude is mainly linked to variations in the thickness of the Lower Jurassic carbonate series which constitutes the framework of this border.

- The Dir (Zone of Piedmont) which corresponds to a narrow strip of fer-

tile land dotted with water sources, in a position of transition between the plain and the mountain. It is essentially formed by a succession of coalescent dejection cone

- The plain of Tadla which extends to the left, a vast agricultural plain drained by the Oum errabia wadi. This plain is the subject of an important hydro-agricultural development fed by the dam of bin el ouidane which we will visit the next day.

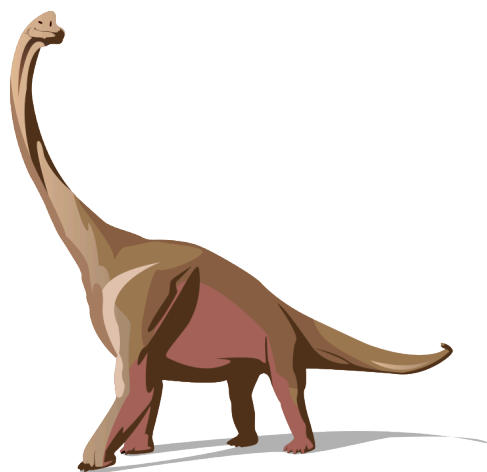
Leaving Afourer, we begin a slow climb in the Atlas range. We leave behind us the plain of Tadla, and we can see the regularity of the developed agricultural perimeters. The first pass reached corresponds to the SIBE zone of the jbel Tazerkout massif (SIBE 1 in the geotourism map).

The road winds down towards the Bin El Ouidane dam. The landscape on the right is marked by a superb view of the Aït Attab syncline that we crossed during the first day, then by the deep gorges dug by Oued El Abid.

## **Stop 9 – Bin El Ouidane Dam**

The Bin el Ouidane dam as a place of rest, it offers the opportunity to understand geology, geography and history at the same time (Fig. 20). The dam was inaugurated in 1954 (during the end of the colonial period), after 5 years of hard work for one of the largest dams in Morocco. The Tadla plain under the mountains benefits from its water for irrigation, the local peasant like the modern farms do modern agriculture for the production of lemons,

tangerines, oranges, sugar beets for the local manufacture of sugar, milk for national enterprises and local cooperatives and many other vegetables and fruits. Bin el Ouidane is connected to the village of Afourer where the electricity factory is located to produce a significant part of Moroccan electricity.





**Fig. 20: Bin El Ouidane Lake**

This dam is located in the space where three rivers intersect. One of them, Ahensal is the river (See geotouristic map) coming from the high mountains where one of the oldest religious lodge in Morocco is located. The river is allied to this religious, mystical and Sufi lodge as the network serving to organize the religious life of the local population, and to participate in local governance in coordination with the governors appointed successively by the central powers. The tribes of the region constitute a rich patchwork of people who came from the Sahara as shepherds and settled and built villages, close to the other tribes who lived there since ancient times, in perfect harmony and complementarity, thanks to several modes of alliance, collective agreements and arbitration of the elected chiefs of tribes and the chiefs of religious lodge, under the authority of a code of perfect organization founded, known in the learned field as a customary law.

## Stop 10 – Azilal Museum

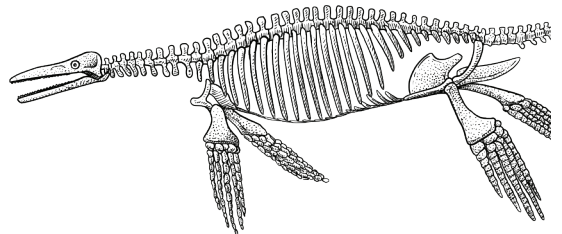
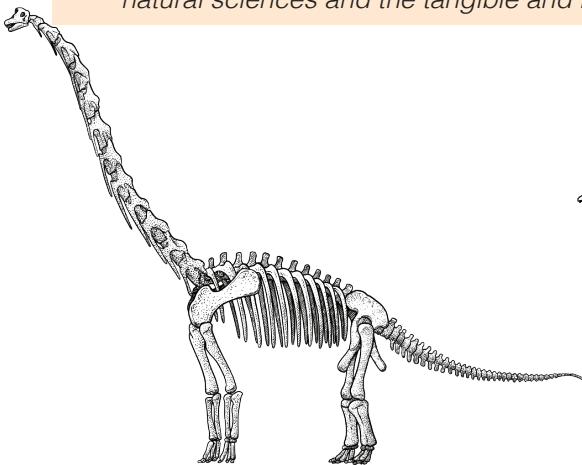
Azilal is the capital of the province where the governor is located. Azilal means a path to the High Mountains, like a pass with regard to its location by geography as an intermediate place between several mountain slopes. This is why during the colonial conquest, the French occupying troops (Morocco was divided between Spain in the North and South, France in the middle) when they attended Azilal in 1917, after immense resistance, built a military Fort and a small «indigenous» village for the leisure of the soldiers. With the definitive occupation of the high mountain in 1933, the village expanded further with the arrival of the first settlers who came from the region to work in services related to local administration. With the consecration of the city as the local administrative capital in 1975, and the emergence of mountain tourism in the high valleys of the Atlas during the 80s and given the richness of the territories of the province, the city acquired its position as a hub Azilal is located in the heart of the M'GounGeopark, and the Geopark Museum is the recognition of the efforts made by all the partners in a perfect partnership between the administration, the NGOs and various actors to promote the values of the Geopark project. Azilal is today one of the means of frequenting the high valleys which have become famous in world guided tourism, such as the localities named AitBougmez, AitBouwlli, ZaouiaAhensal and Ait Abbas. Huge movements of local and international tourism visit the region to hike or to enjoy the subliminal natural, human, cultural and architectural views offered by the population's heritage and activities. The Geopark's Museum offers visits to the local and national visitors, but also for international tourism concerned with the ecological and natural tourism offered by the region. It is a new way to boost the economy of the city and the region.

## AZILAL MUSEUM



**Atlasaurus imelakei**

*The Azilal Museum is an excellent work (1,720 m<sup>2</sup>) which is distinguished by its domed architecture. It is an exhibition space for the natural and cultural heritage of the Geopark. The scientific topics are diverse, and they illustrate the Atlas geological history, natural resources, archaeological, architectural and ethnic peculiarities of the territory of the Geopark territory. The scenography is designed according to a tunnel of knowledge which leads to a dome housing the famous dinosaur that lived in the region: «Atlasaurus Imelakei» around which various themes relating to paleontology, the major fossiliferous groups of Morocco and the giant dinosaurs of the Atlas. The Azilal Museum is also a place of training and education that allows young visitors and the general public to access to knowledge of the marvels of the natural sciences and the tangible and intangible heritage of the territory.*









# NOTES

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