GEODIVERSITY WORKSHOP 5 celebrating
THE INTERNATIONAL GEODIVERSITY DAY
GEODIVERSITY OF THE MIDDLE EAST

ACE
Association for Community & Environment
جمعيـــة المجتمـــع والبيئـــة
Reg #2109

Geodiversity of Lebanon



A Resource for Sustainable Development
& the Need for Geo-Education

SOUMAYA AYADI MAASRI, PHD

JULY 27 2022

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    Endokarsts and caves
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Etymology

The name **Lebanon** comes from the Semitic root **lbn** meaning "white" or "milk", in reference to the **Snow Cap** covering Lebanese mountains in winter.

A second explanation associates "**Lebanon**" with the name of incense, which comes from the incense tree called **loubân** by the Semites.

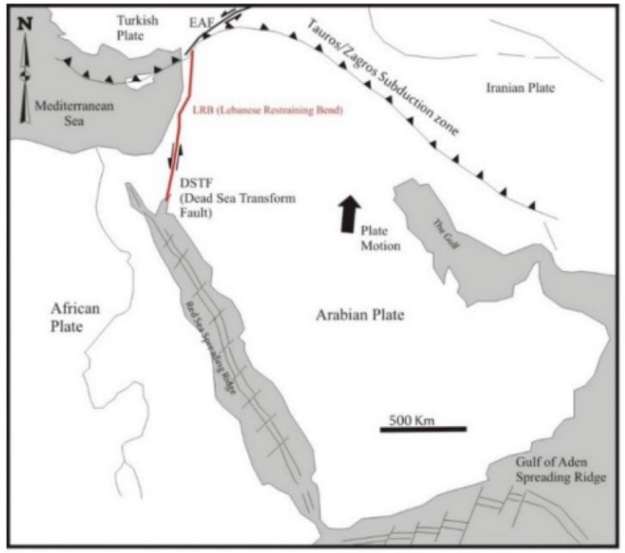


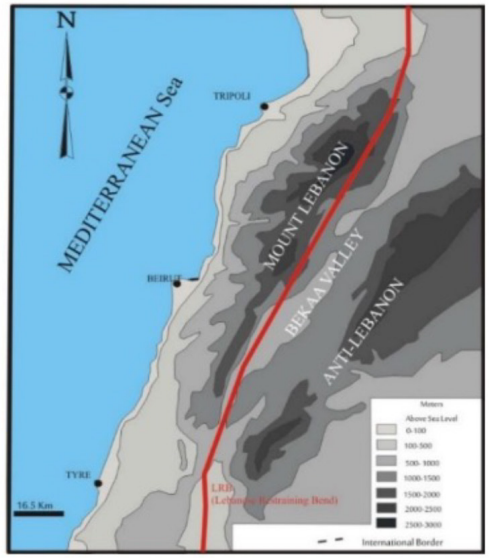
Geographical location



Localisation of Lebanon in the Mediterranean Basin (Google Earth)

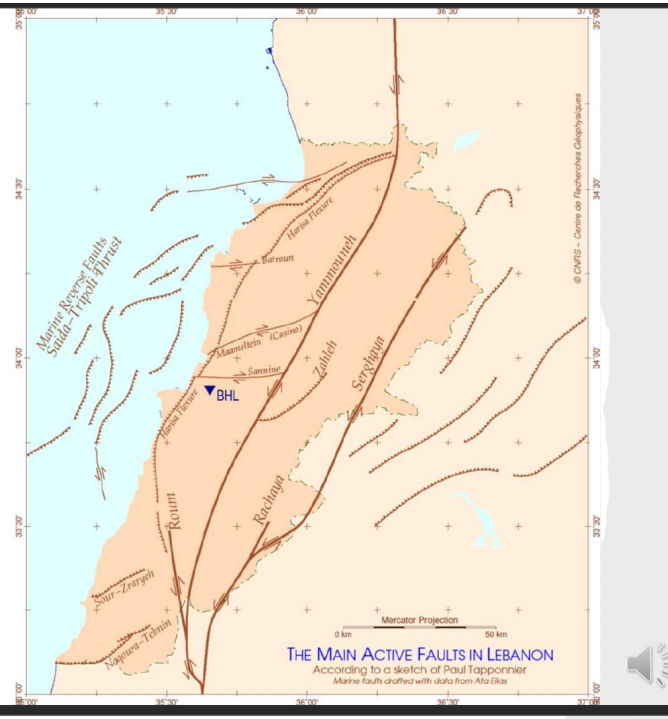
Geological localization

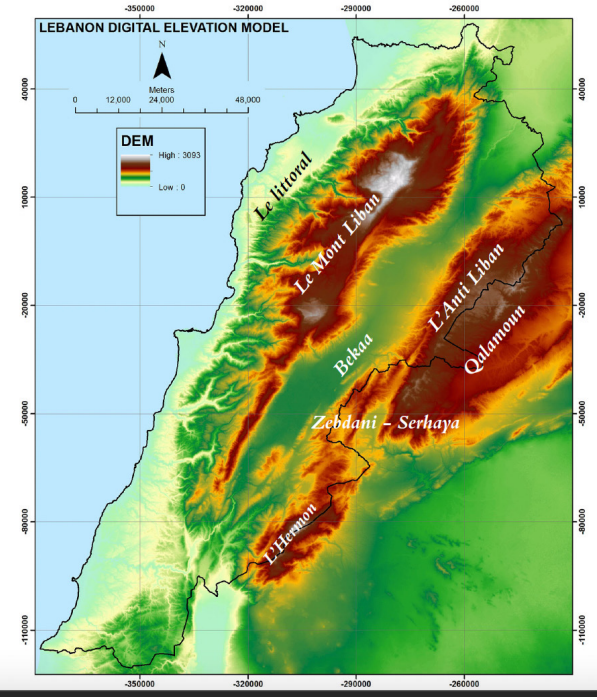


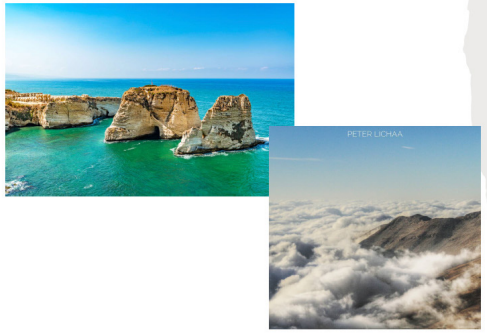


Structural and Topographic Setting of Lebanon

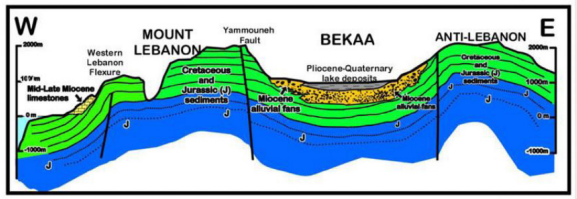
Structural map





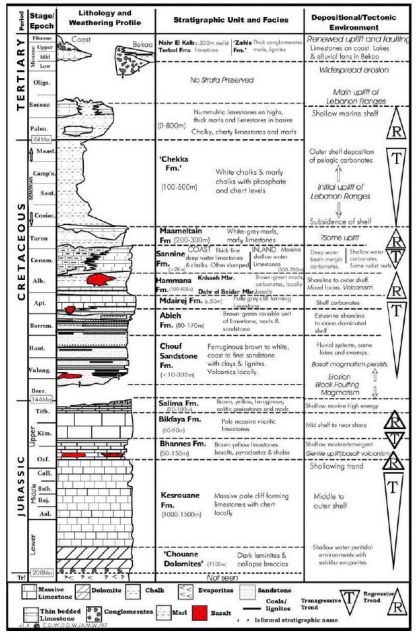


Over the Clouds (Kornet El Sawda)



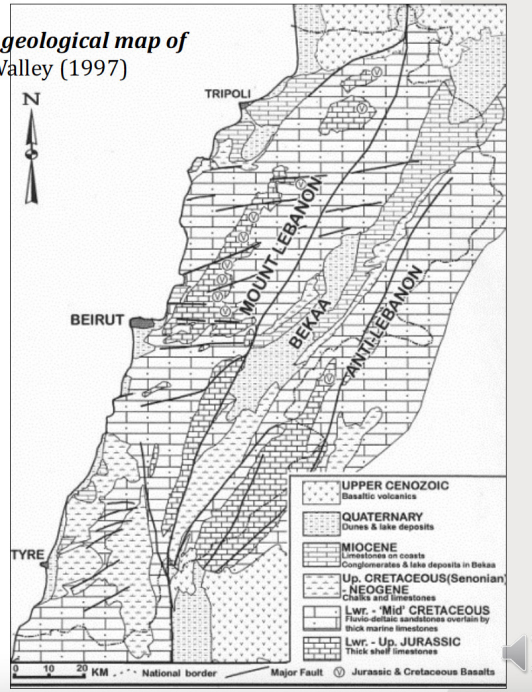
Schematic east-west cross section across Northern Lebanon

SOUMAYA AYADI MAASRI, PHD



Stratigraphic synthesis

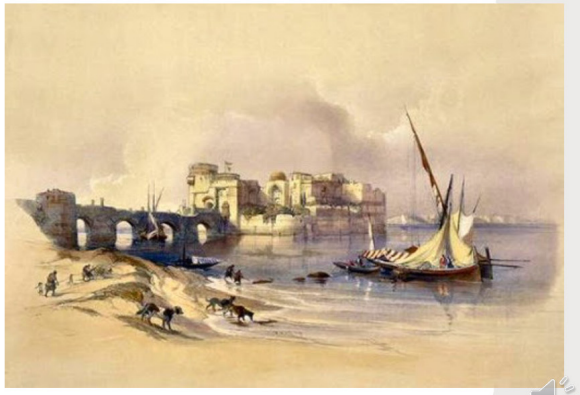
Simplified geological map of Lebanon Walley (1997)



Geology has deeply controlled the history of Lebanon:

- It gave Lebanon its high mountains and its inaccessible valleys, which transformed the country into an excellent refuge
- It has given the country excellent ports.

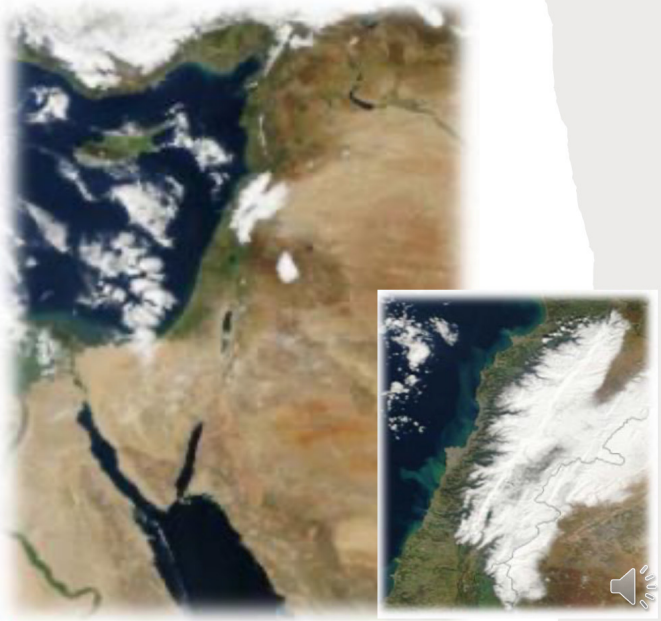




Hydrological network

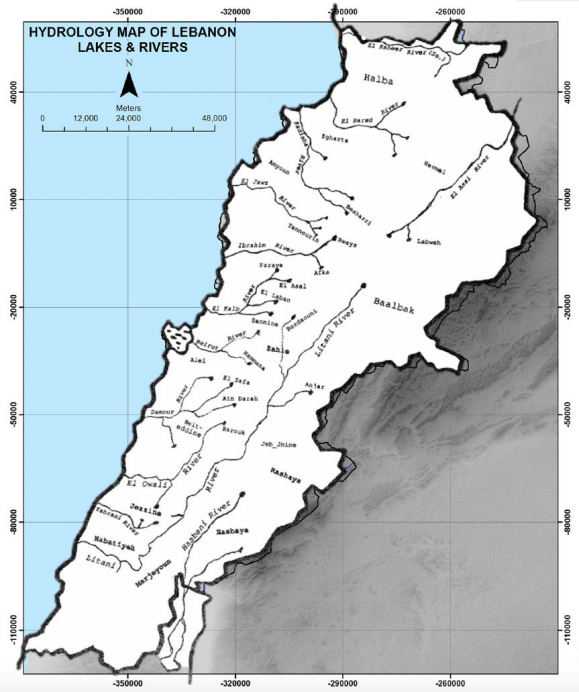


Snow coverage in Europe as of January 20, 2021.



Hydrological network





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Hydrological network



NAHR EL KALB
SOURCE LABAN



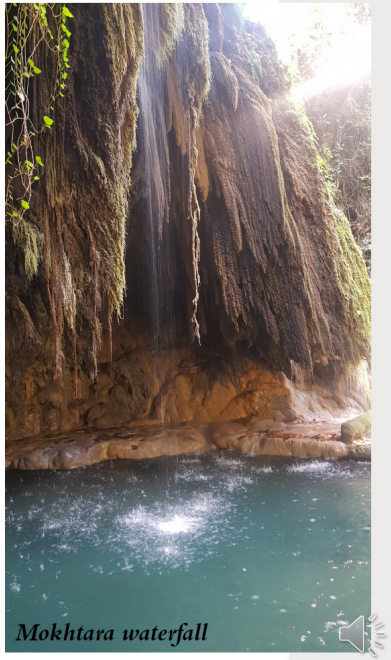
NAHR IBRAHIM
SOURCE AFQA

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Baakline, waterfall in lush vegetation.



Mokhtara waterfall

Geological heritage
Fossils

LEBANESE AMBER

145 - 100 million years ago



Beirut

Mountains of Lebanon, to the southeast of the country's capital - Beirut.

First inclusions

The oldest fossil remains were found inside Lebanese amber.

Importance

Amber and amber inclusions were increasingly important for making discoveries.

www.nammu.com info@nammu.com

https://nammu.com/eng/how-old-is-amber/

Amber Deposits Worldwide & in Lebanon

Location of amber deposits in the world

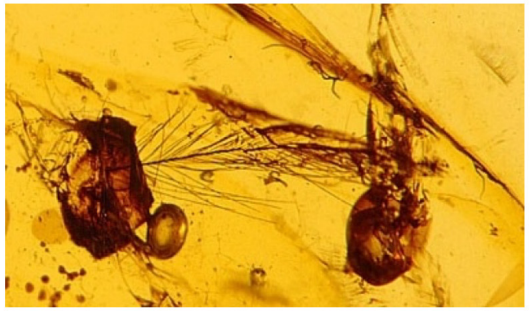
(1) Afrique du Sud, (2) Allemagne, (3) Angleterre, (4) Australie, (5) Autriche, (6) Brésil, (7) Canada, (8) C.E.I. et ex-URSS, (9) Espagne, (10) Etats-Unis, (11) France, (12) Golfe Persique, (13) Hongrie, (14) Palestine occupée, (15) Japon, (16) Italie, (17) Jordanie, (18) Liban, (19) Myanmar (Birmanie), (20) Nouvelle-Zélande, (21) Thaïlande.



Significant Amber Deposits Worldwide & in Lebanon

So far, only seven major deposits have provided significant quantities of fossil inclusions:
Lebanon, Spain, and Myanmar ***for the Lower Cretaceous;***
Canada, Siberia (Taimyr, Dolgan formation), and the United States (New Jersey) ***for the Upper Cretaceous.***

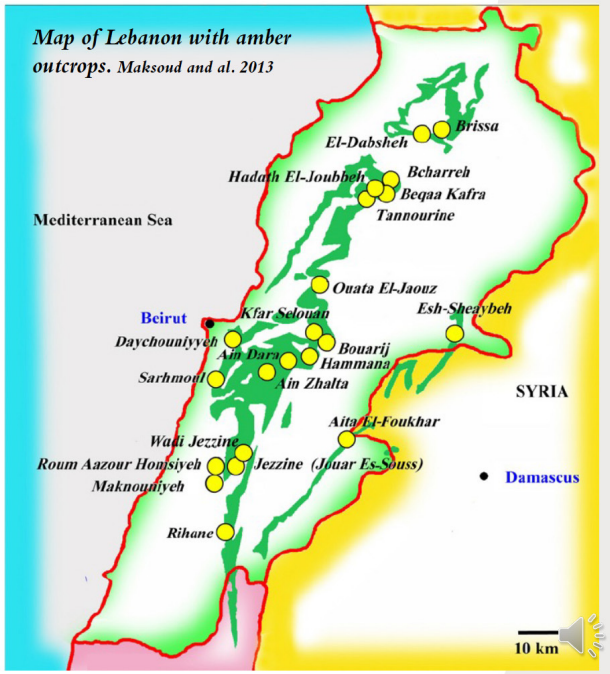




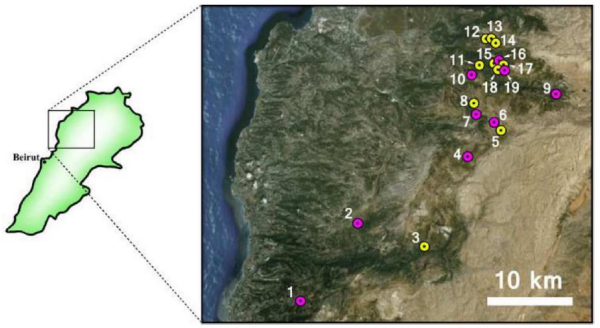
Lebanese amber, a wonderful time machine



http://www.lorientlejour.com/article/811866/lambre-libanais-formidable-machine-a-remonter-le-temps.html



Jurassic amber outcrops in Lebanon



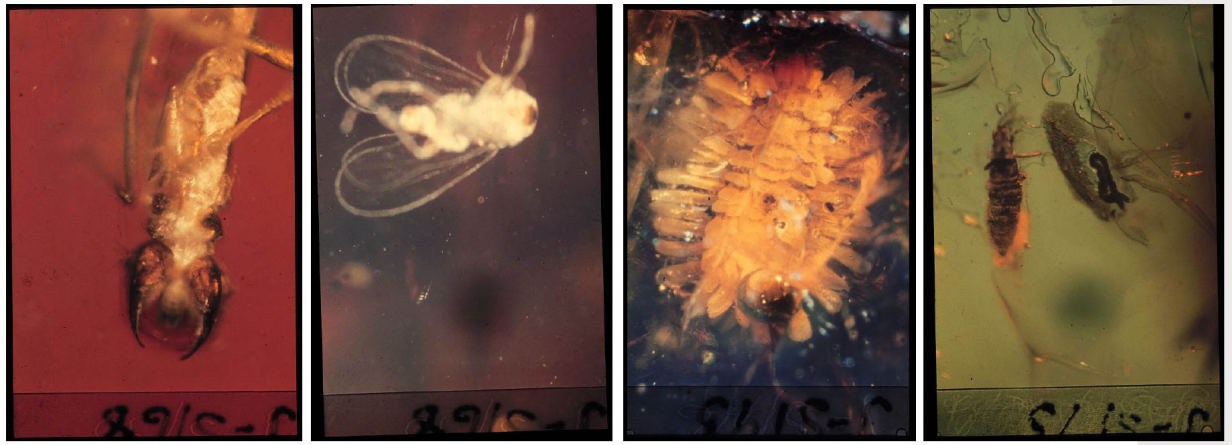
Map showing all the Late Jurassic amber localities in Lebanon.



Amber from the outcrop of Aaintourine. Coin diameter = 24 mm.

Y. Nohra et al. / Terrestrial Arthropod Reviews 6 (2013) 27–51

Biological Inclusions in Lebanese Cretaceous Amber



Prof. Aftim Acra collection, American University of Beirut

Biological Inclusions in Lebanese Cretaceous Amber



Prof. Aftim Acra collection, American University of Beirut

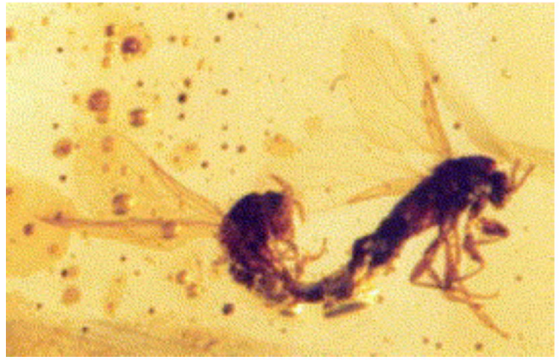
Conservation and accumulation of biological inclusions in Lebanese amber



Two mite larvae belonging to the same species, found in a piece of amber containing 54 identical larvae. A drop of resin must have fallen on them right after egg hatching.

Dany Azar

The oldest insect mating

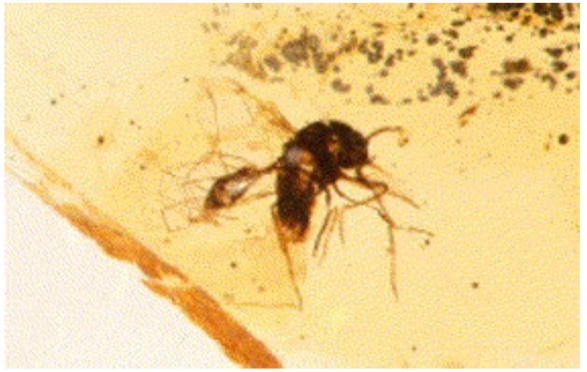


Mating of Diptera of the Scatopsidae family. It is the oldest preserved pairing in the animal kingdom (D. Azar et al. 2010).



Two ceratopogonids that were mating when the drop of resin surprised them.

The oldest known parasitism in the world (a mite feeding on an insect)

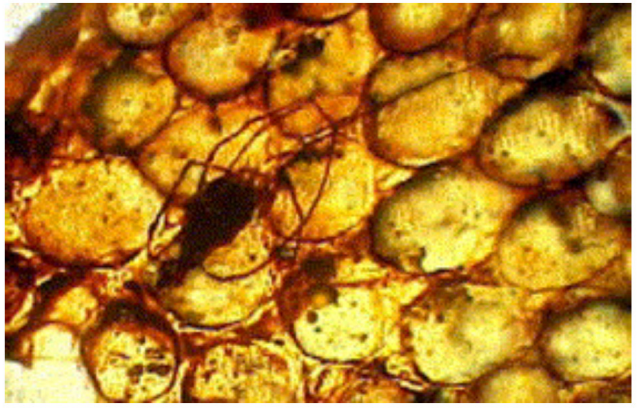


The oldest known parasitism in the world (a mite feeding on an insect)

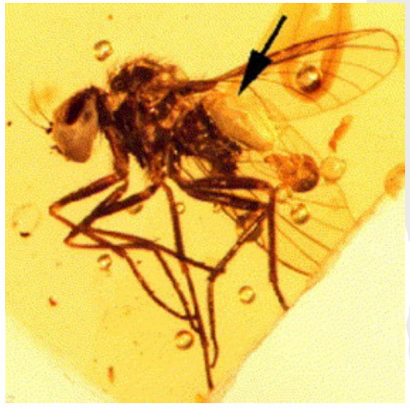


The oldest fossil nematode (Mermithidae)

Dany Azar



The oldest preserved parasitism in vertebrates: a mite that parasitizes reptile skin.



A rhagionid parasitized by a mite. The arrow points to the mite.

Dany Azar

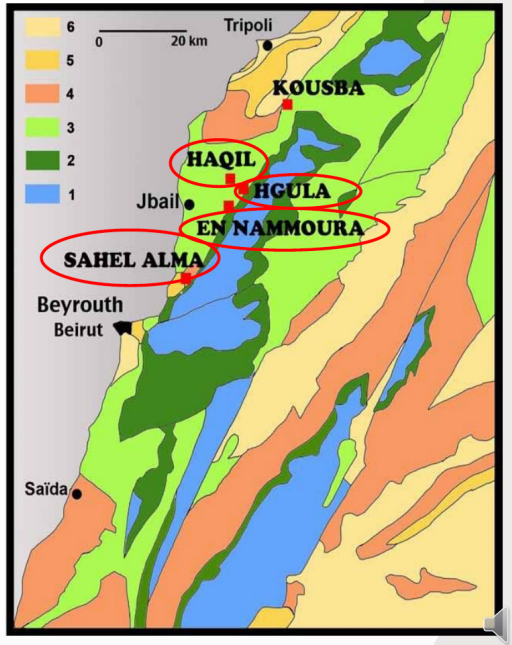
To sum up, ***Nature*** has endowed Lebanon with ***a unique wealth of Biological inclusions in its Amber,*** including the:

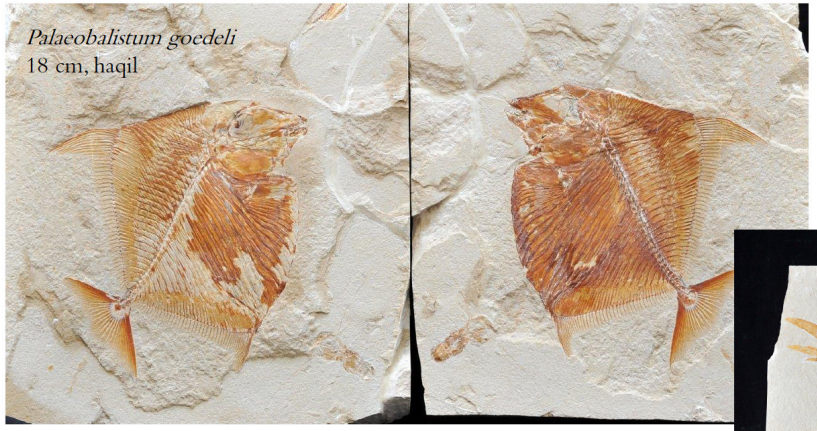


- oldest butterflies in the world,
- oldest insect mating,
- oldest known parasitism in the world (a mite feeding on an insect),
- oldest lizard,
- oldest gastropod (snail),
- oldest sandflies (kind of small mosquitoes that can transmit diseases)…

FISH FOSSILS DEPOSITS











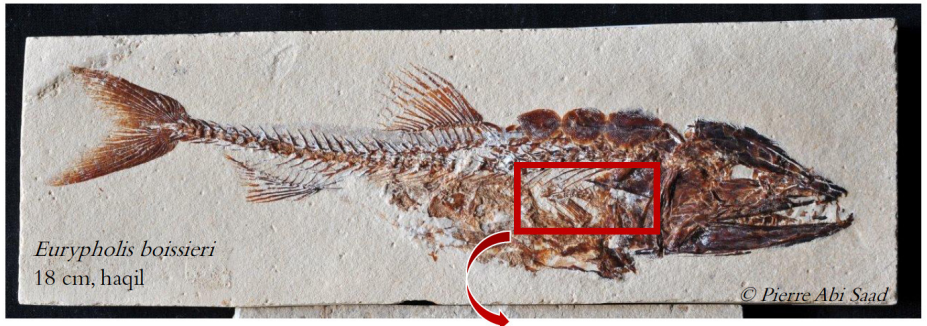




Rajorhina expansa
24 cm, Haqil

© Pierre Abi Saad







With a fish within its stomach

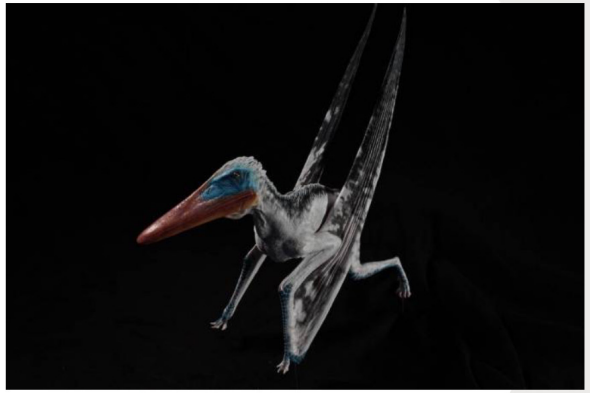


Mémoire du temps

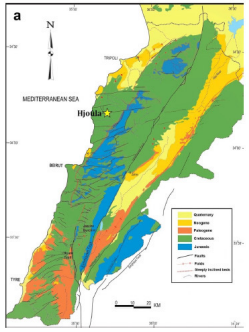


DINOSAUR SKELETON



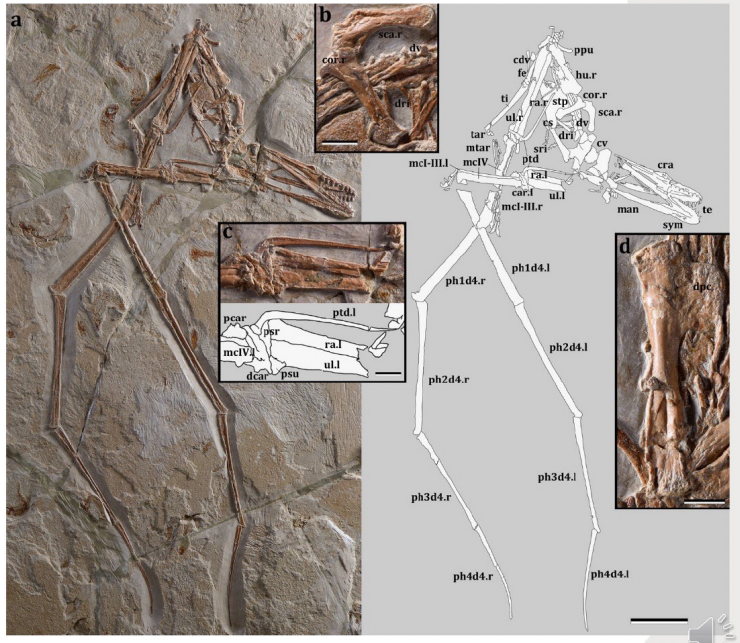


Mimodactylus libanensis • First Complete Pterosaur from the Afro-Arabian Continent





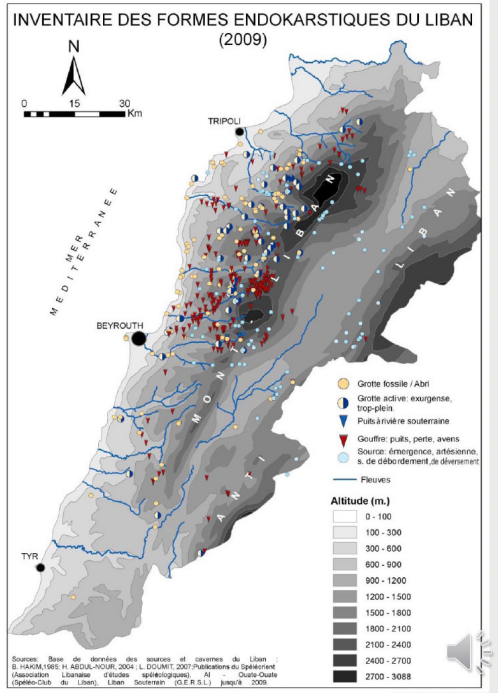
Mimodactylus libanensis (W. A. Kellner, 2019)



Geomorphological heritage

ENDOKARST

Given the extent of carbonated rock deposits, the Lebanese geomorphologic heritage consists mainly of karst sites with considerable development of exokarst (lapiaz, dolines) and endokarst (more than 500 caves identified) (C. Nehme, 2009).

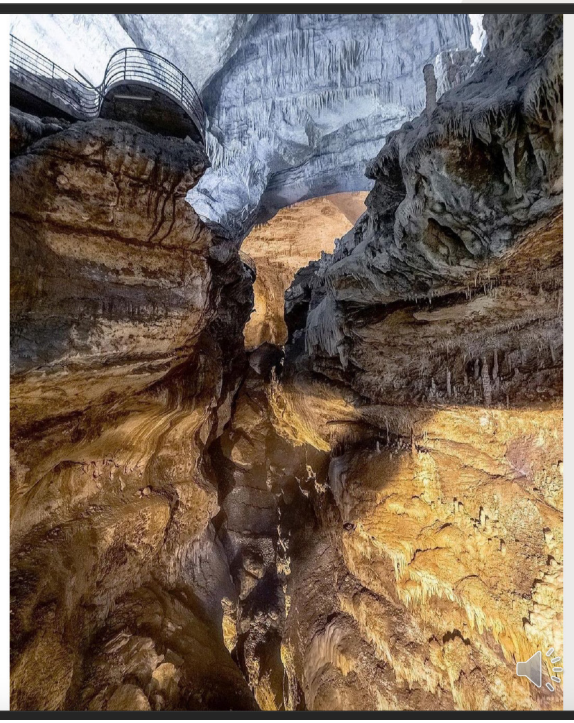


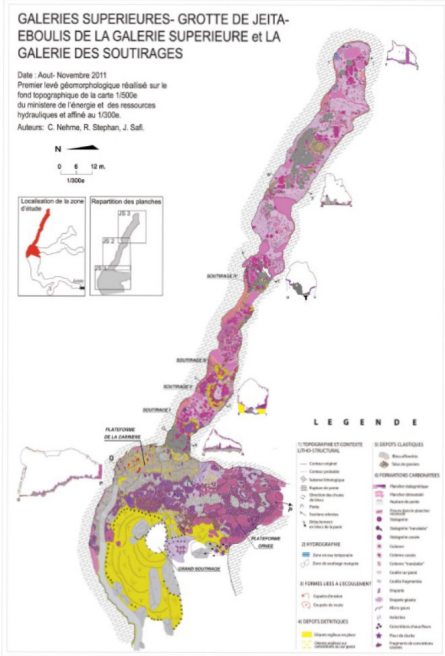
Inventaire des sites endokarstiques du Liban en 2009 (C. Nehme).

JEIITA GROTTO

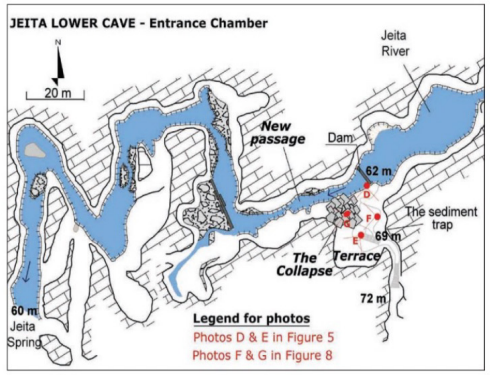
It is located in the valley of Nahr el Kalb at 18 km North of Beirut.

The grotto is located within the Lower-Middle Jurassic strata, which has a stratigraphic thickness of 1,000 metres, and consists of dolomite and micritic limestone.









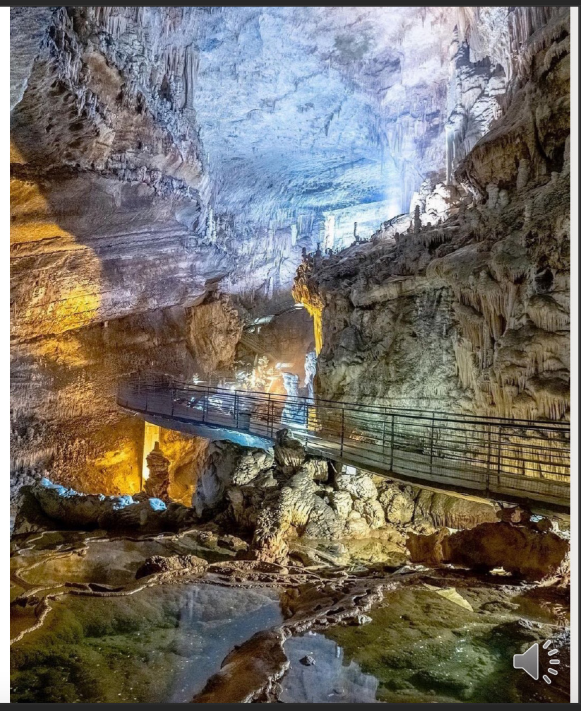
The map of the Entrance Chamber (Lower level)
(Map in Karkabi et al., 1960, in C Nehme et al. 2015).











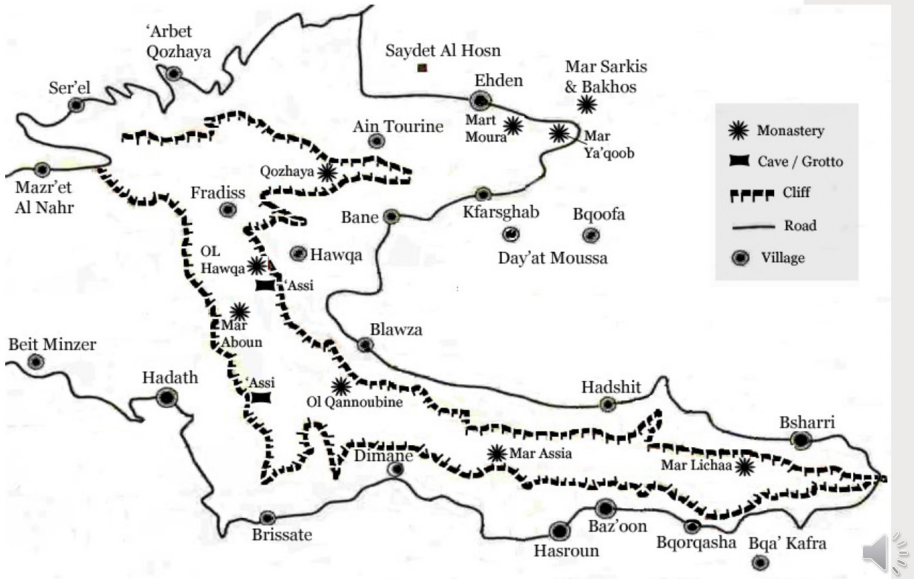
EXOKARST

THE NATURAL BRIDGE OF KFARDEBIAN



SAINT VALLEY OF QADISHA


Location of Kadisha Valley

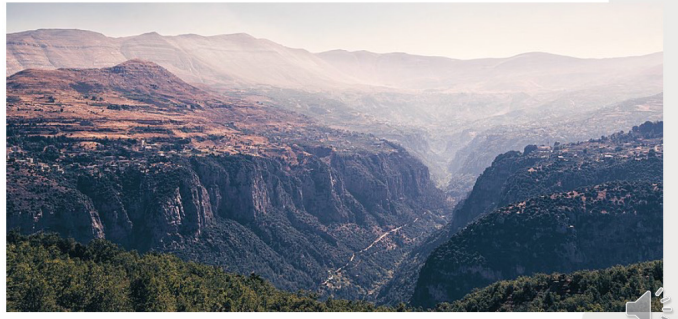




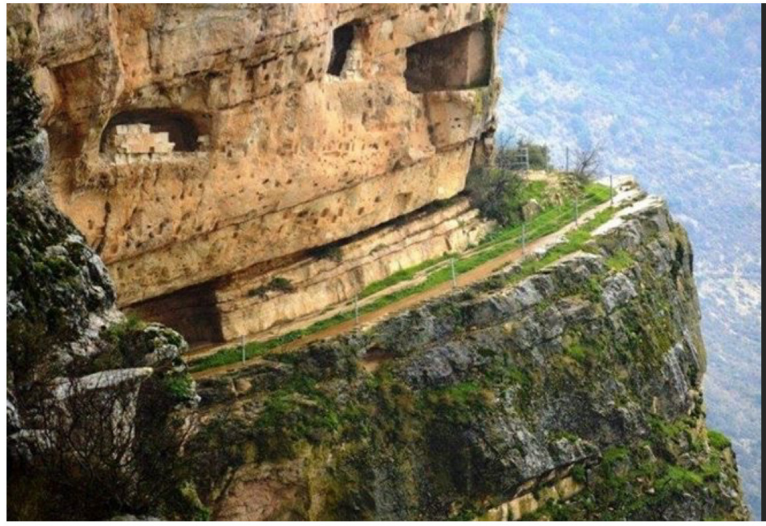
A very spiritual location with some of the oldest christian monastries in the Middle East, including:

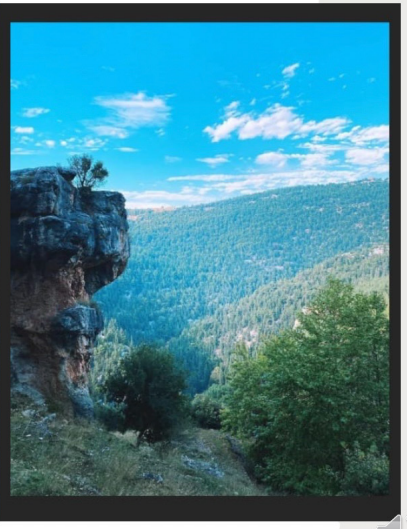
- Monastry of Qannoubine
- Monastry of Saint-Antoine de Qozhaya





CAVE OF THE FORTRESS OF NIHA



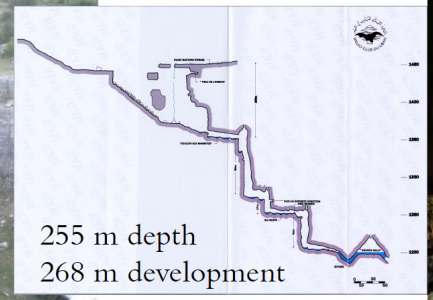


THE NATURAL WATERFALLS OF JEZZINE



BAATARA SINKHOLE
THE THREE NATURAL BRIDGES







The Baatâra sinkhole : an exceptional site, with three natural bridges





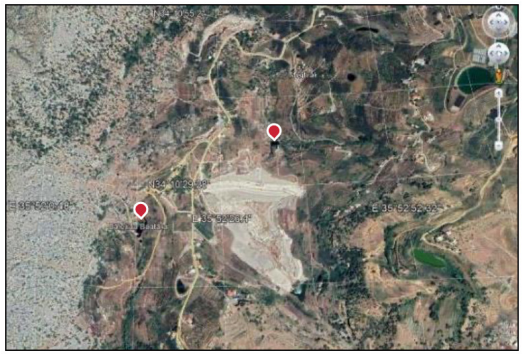






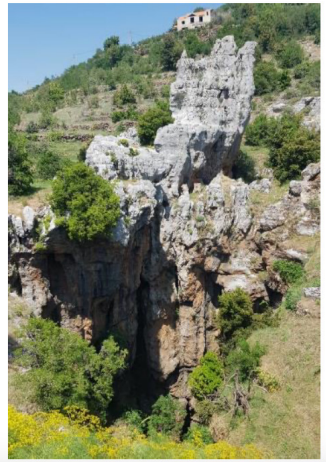


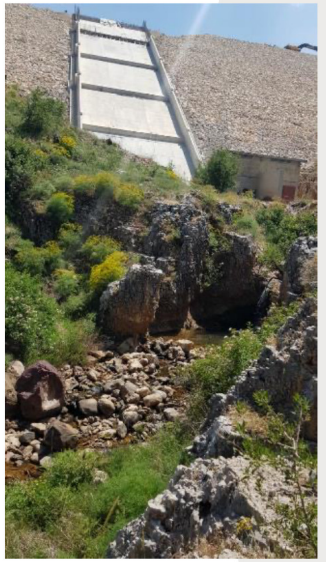












Balaa sinkhole and Balaa Dam !!



Ammiq Wetland

The wetland of Ammiq is the largest remaining freshwater humid zone in Lebanon, well spread in the southwestern Bekaa Valley.



The humid Zone of Ammiq



https://www.looduskalender.ee/forum/viewtopic.php?t=2&start=12520



The humid Zone of ANJAR



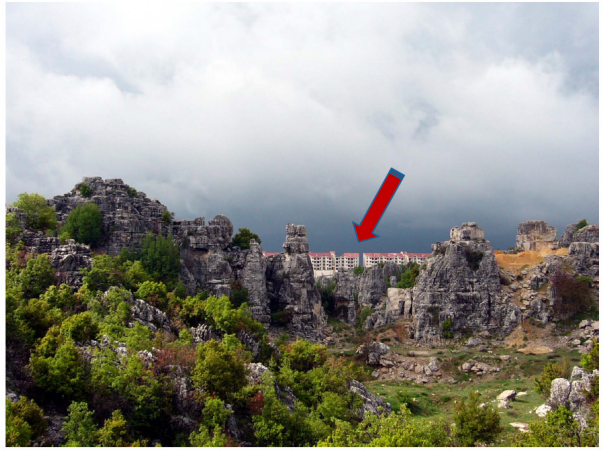
Geoconservation – legislations

In 2014, The Physical Master Plan for the Lebanese Territory underscored the geological heritage, highlighting the karstic morphology, and certain fossiliferous sites of great value.

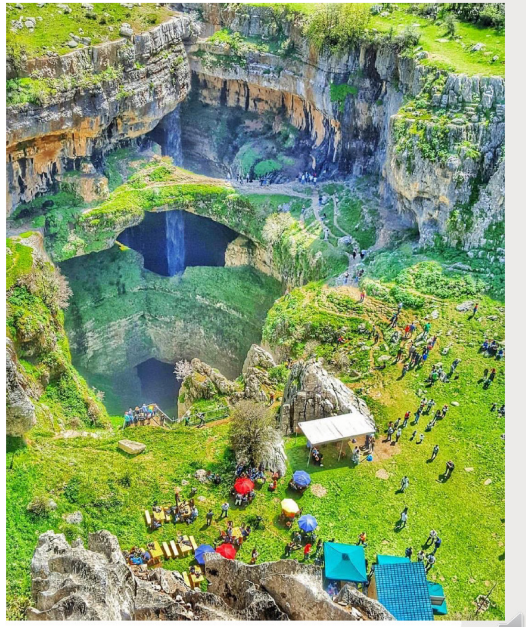
In 2019, the Ministry of Environment issues decree n130 within the "Protected Areas Law". For the first time, the geological, geomorphological or anthropological importance of certain regions is taken into consideration to declare them as nature reserves.



Anthropogenic pressures



FAYTROUN



BAATARA

Sustainable development? GeoEducation

Sustainable Development?





BioConnect

Association for Community and environment
جمعية المجتمع والبيئة

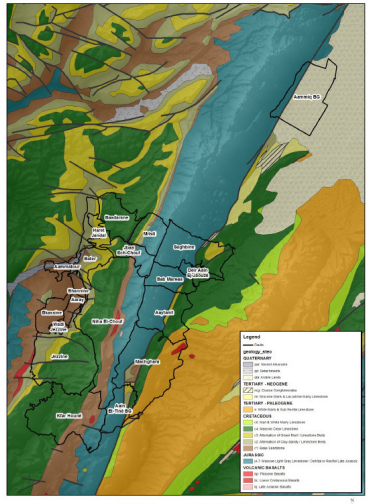
Association for the development of Rural Capacities
جمعية انماء القدرات في الريف

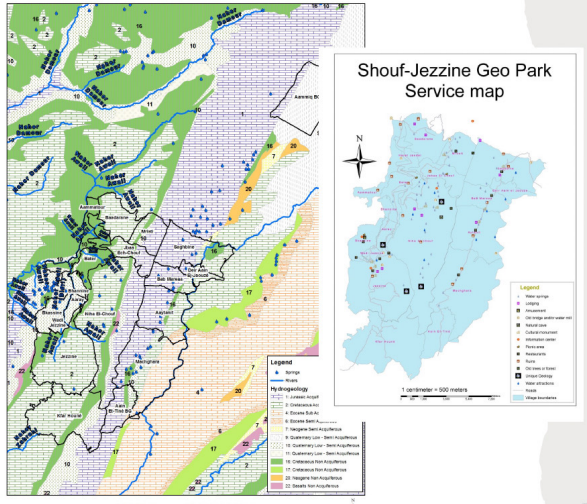
Society for the Protection of Nature in Lebanon
جمعية حماية الطبيعة في لبنان

Al- Shouf Cedar Society
جمعية ارز الشوف

BioConnect

Geopark – Geotrails - GeoEducation





EUROPEAN UNION

NEED FOR PROTECTION :

Geopark :

- Protection of geological traits
- Protection of natural resources
- Tools for conservation
- Tools for sensibilization and relationship between the individual and natural setting
- Giving common objective to the community related to natural resources

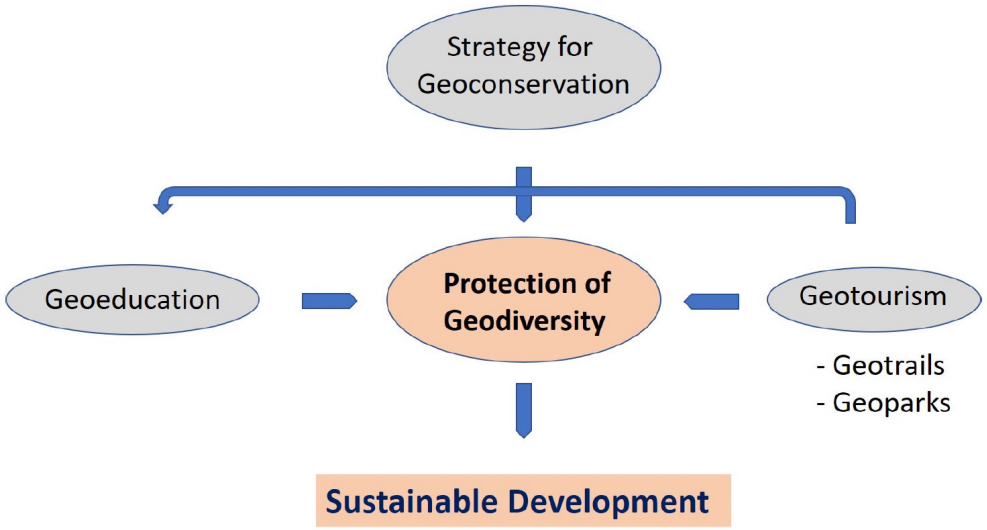
Current perceptions and challenges ahead

SCIENCE IS BEING OVER-LOOKED

- Engineers and contractors play a pivotal role in decision making in Lebanon and have in many ways excluded sciences in strategic planning and decision making.
- Real estate and infrastructure developers view science and geology as a limiting factor in their immediate wealth generation on the expense of the country's natural resources and landscape.
- Preservation of resources and environmental protection are for most developers "worst case" scenarios.

Thus, it is important to start immediate action on policy making and education to:

- Mainstream science in decision making
- Identify and protect natural resources
- Valorize geodiversity as a heritage



GEODIVERSITY WORKSHOP 5 celebrating THE INTERNATIONAL GEODIVERSITY DAY
GEODIVERSITY OF THE MIDDLE EAST

ACE
Association for Community & Environment
جمعية المجتمع والبيئة
Reg #7109

THANK YOU

Soumaya Ayadi, PhD

