

Morocco

**Palaeontological Tour organised by the
Geologists Association**

November 2024

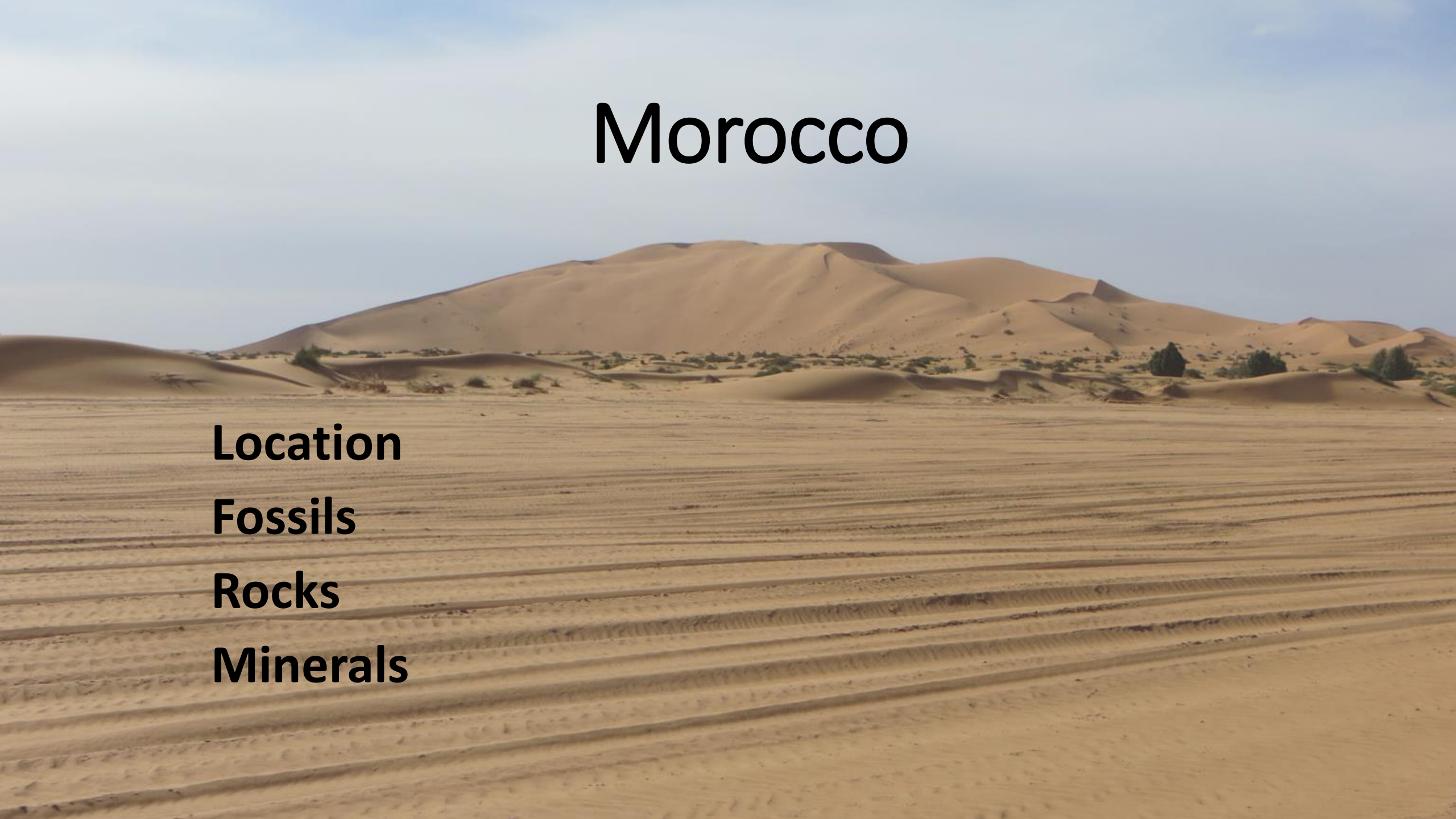
Morocco

Location

Fossils

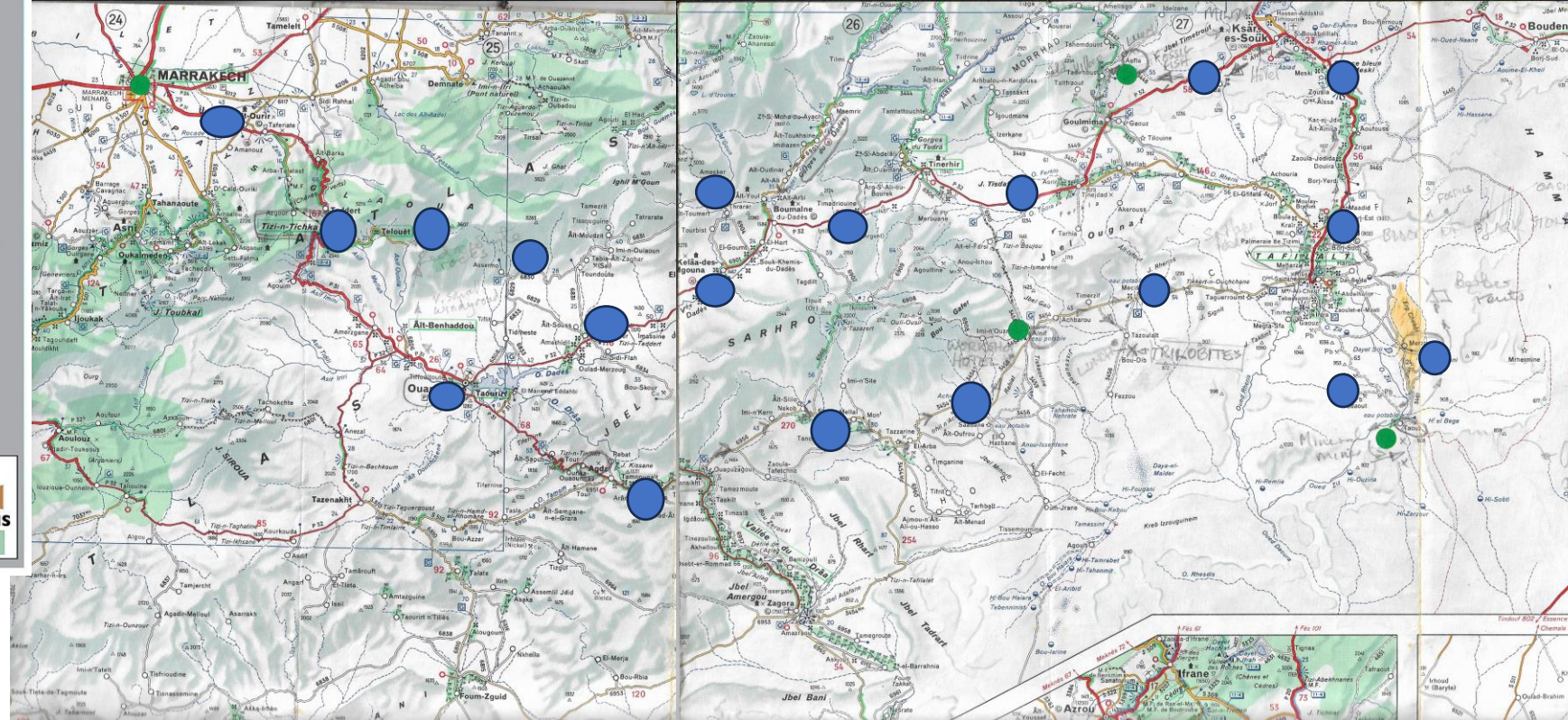
Rocks

Minerals





Our route across the Atlas Mountains to the Sahara



Marrakesh Ouarzazate Alnif Merzouga Erg Chebbi Erfoud
Ksar es-Souk Asfla Goulmima Gorge du Todra Gorges du Dades

Ancient fossils: Stromatolites, 600 Ma,

- Mounds built in a warm shallow sea by colonies of cyanobacteria, that became cemented together with calcite.
- Stromatolites are thought to have been responsible for the Great Oxygenation Event 3000 mya. (banded iron formation)
- Stromatolites declined over time due to grazers nibbling them; they haven't, as yet, gone extinct.

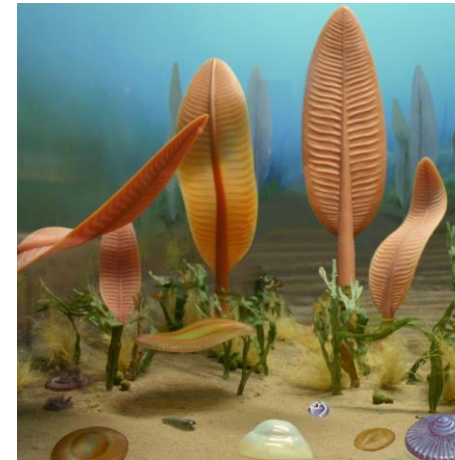


Cyanobacteria grow in shallow salty water. They form clumps that trap silty sand.
A colony of live ones are growing today in western Australia.

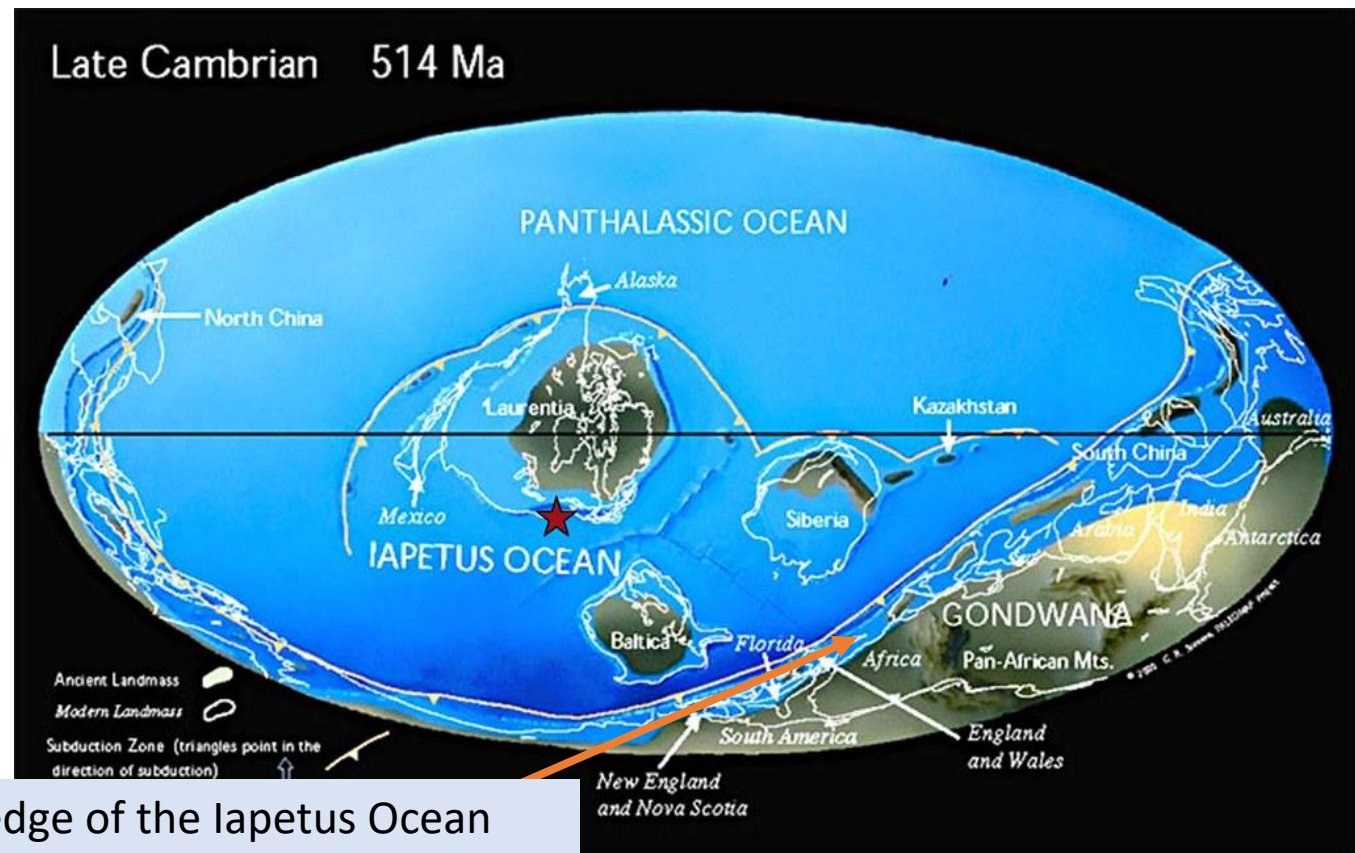


Morocco at the edge of the Iapetus Ocean

Other life forms 600 Ma were tubular and frond-shaped, mostly sessile, the Ediacaran organisms. These went extinct at the Cambrian explosion, 521 Ma



At the start of the Cambrian period, 521 Ma, a wide range of creatures developed, amongst them.....



Trilobites



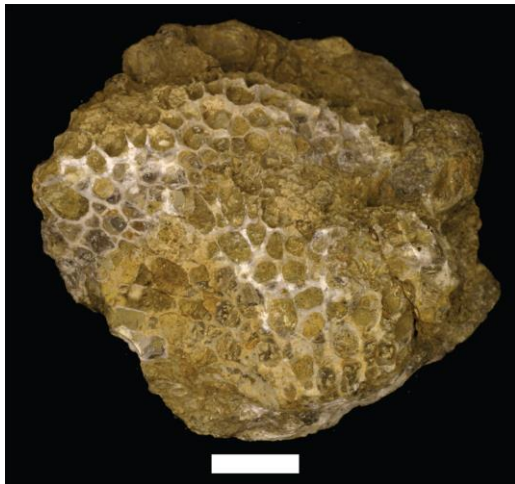
- Trilobites are some of the most successful of all early animals. They first appeared 521 million years ago. They were widely dispersed and varied; 22,000 different species have been described
- Many went extinct in the Devonian period, 400 Ma, the rest at the end of the Permian, 250 Ma.
- These Moroccan trilobites are Devonian in age



The Mud Mounds of Hamar

There are about fifty of these mounds in the area 20km SE of Erfoud, the highest mound rising up to 55m. All of Devonian age.

Consist of solidified carbonate mud of microbial and biodetritral origin with many coral fragments.



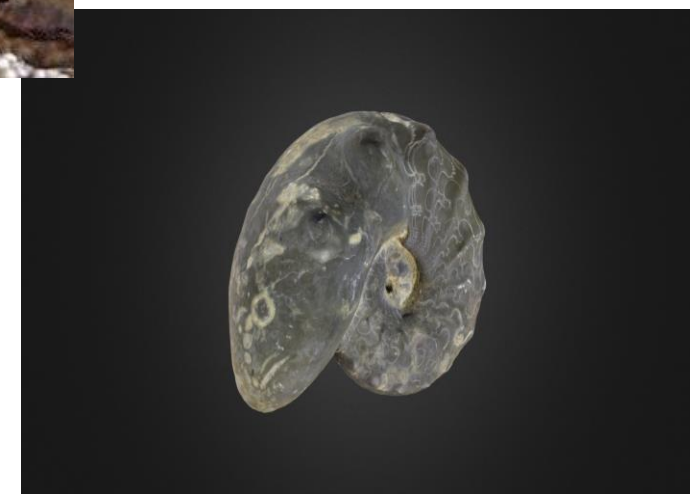
Named the **Kess-Kess Formation** – their shape resembles the cooking pots used to prepare couscous

Originally described as coral reefs (1934), then mud mounds (1973), currently (1994) as **submarine hydrothermal vents** formed when to underlying magmatic activity pushed gases up faults in the crust

Up-welling methane gas may have been bacter to carbonate precipitation and eventual lithification
Surrounding the mounds were abundant corals
Also crinoids, conodonts and cephalopods



a bobbitt

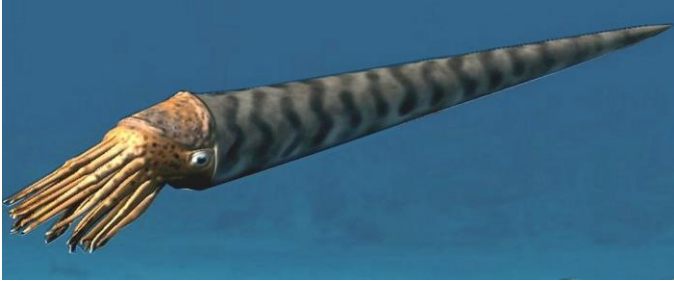


Crinoids

Marine invertebrates related to sea urchins and starfish. Occur here in very large numbers



Cephalopods



Nautilus, the present day relative of earlier forms

Goniatite and Orthoceras, extinct cephalopods whose fossils are found in abundance in Morocco





Fossils for sale



The Kem Kem beds — a Cretaceous hothouse, deltaic environment

- Crocodiles
- Dinosaurs eg spinosaurus and plesiosaur
- Freshwater fish eg coelacanth and lungfish

- Ammonites
- Sharks
- Rays



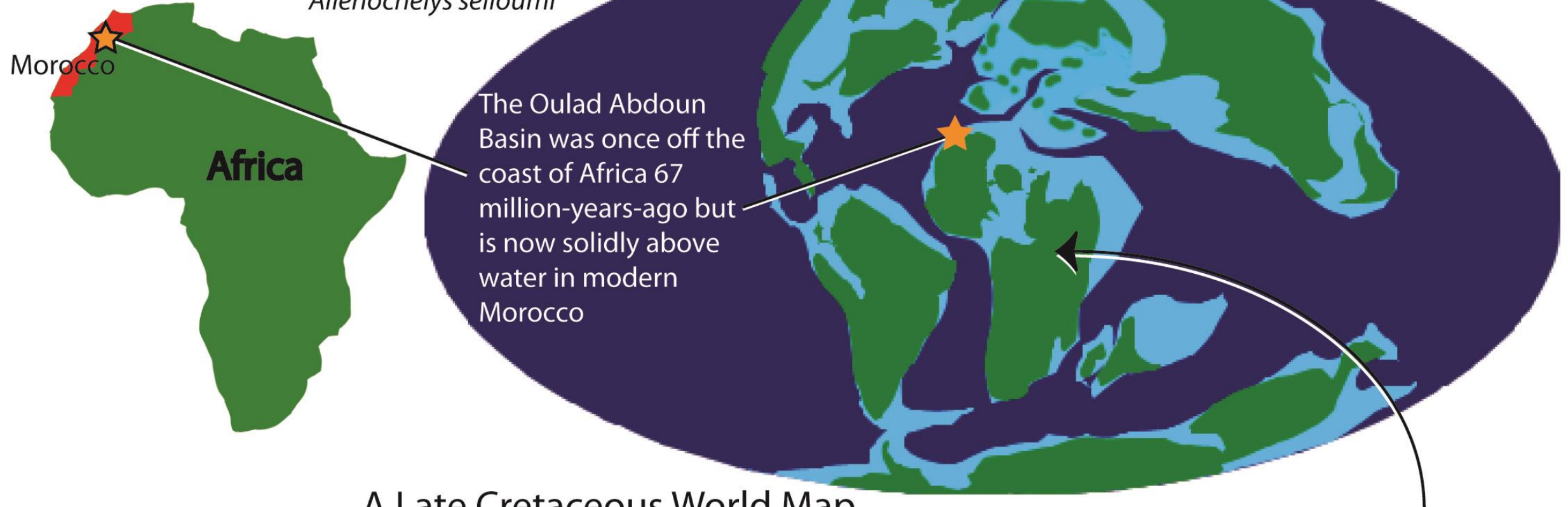
Morocco: Home of Giant, Ancient Turtles



Alienochelys selloumi



Ocepechelone bouyai



The Oulad Abdoun Basin was once off the coast of Africa 67 million-years-ago but is now solidly above water in modern Morocco

A Late Cretaceous World Map

Notice Africa is not connected to Asia, leaving an open ocean between the continents

Rocks.....



- desert stones..... highly polished pebbles across the arid landscape
- Devonian mudstone and Cretaceous limestone in the places where we were looking for fossils
- Bright orange-red Devonian sandstone south east of Marrakech in spectacular road cuttings and gorges



and minerals



Desert roses

Gypsum and Barites

$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ and BaSO_4

The result of rain water seeping down through desert sand becoming enriched in calcium and barium salts and then depositing them as the water subsequently evaporates

Galena PbS

Vanadinite $\text{Pb}_5(\text{VO}_4)_3\text{Cl}$

Haematite Fe_2O_3

Evidence of igneous activity....
Hydrothermal fluids exploited faults in the limestone resulting in veins of lead, iron and vanadium minerals





