Recent and Ancient Carbonate Mounds in Morocco

CoCaRDE

CoCaRDE Workshop and Field Seminar

by Bodil Wesenberg Lauridsen

What is CoCaRDE?

COld-water Carbonate Reservoir systems in Deep Environments

CoCaRDE is a Industry-Academia partnership to consolidate and amplify mound research and capacity building founded and cofounded by ERC, EC, ESF and national founding sources

A large network of European, Canadian, Russian and Moroccan scientist.

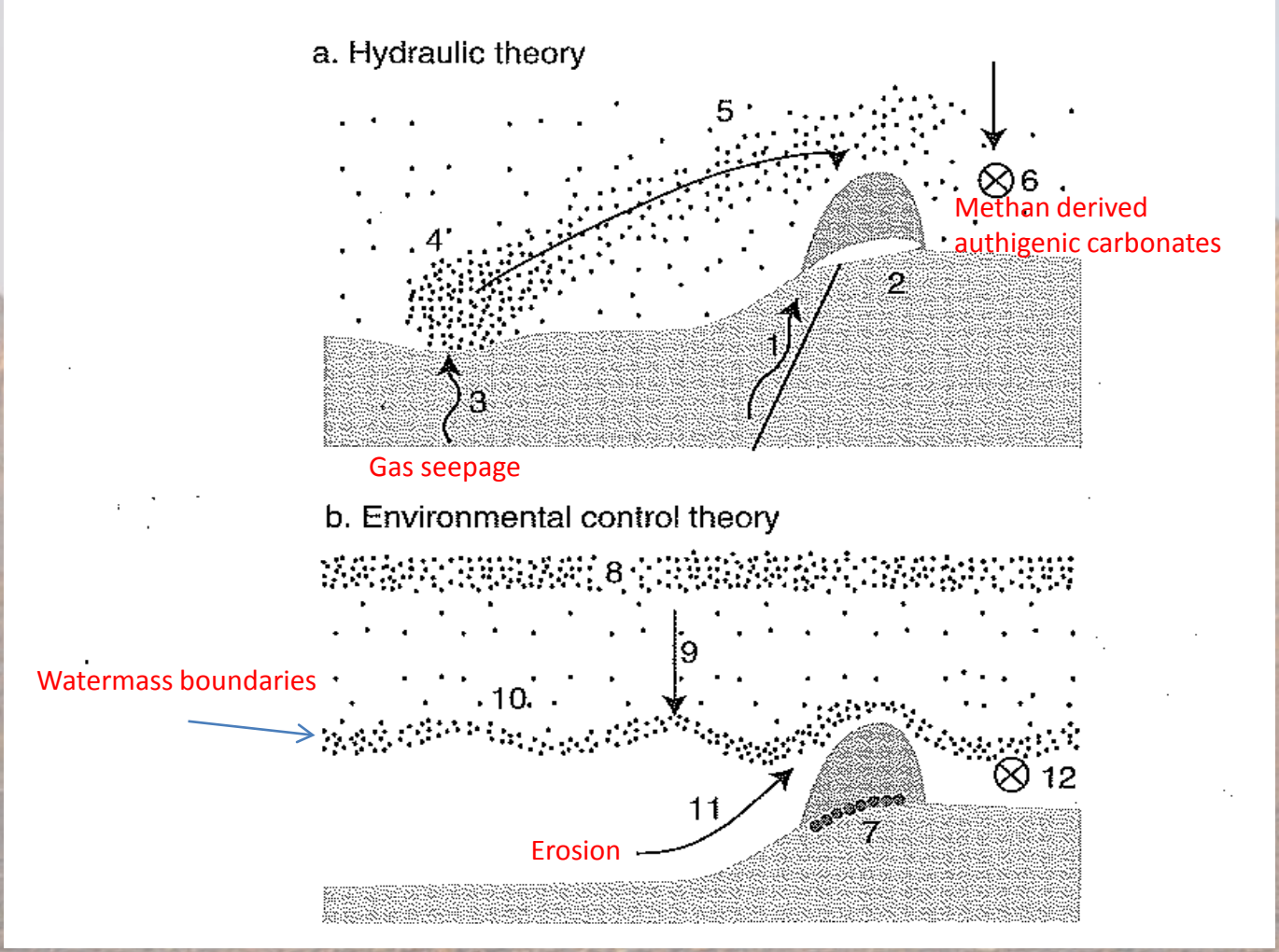
Recent and ancient Carbonate Mounds in Morocco

- 2 days of workshop and discussions on recent and ancient carbonate mounds in Morocco and in Europe
- 5 field seminar days in outcrops of carbonate mounds and carbonate factories from Ordovician to Jurassic ages in the Central High Atlas and eastern Anti-Atlas at many localities in Morocco

How to define a mound?

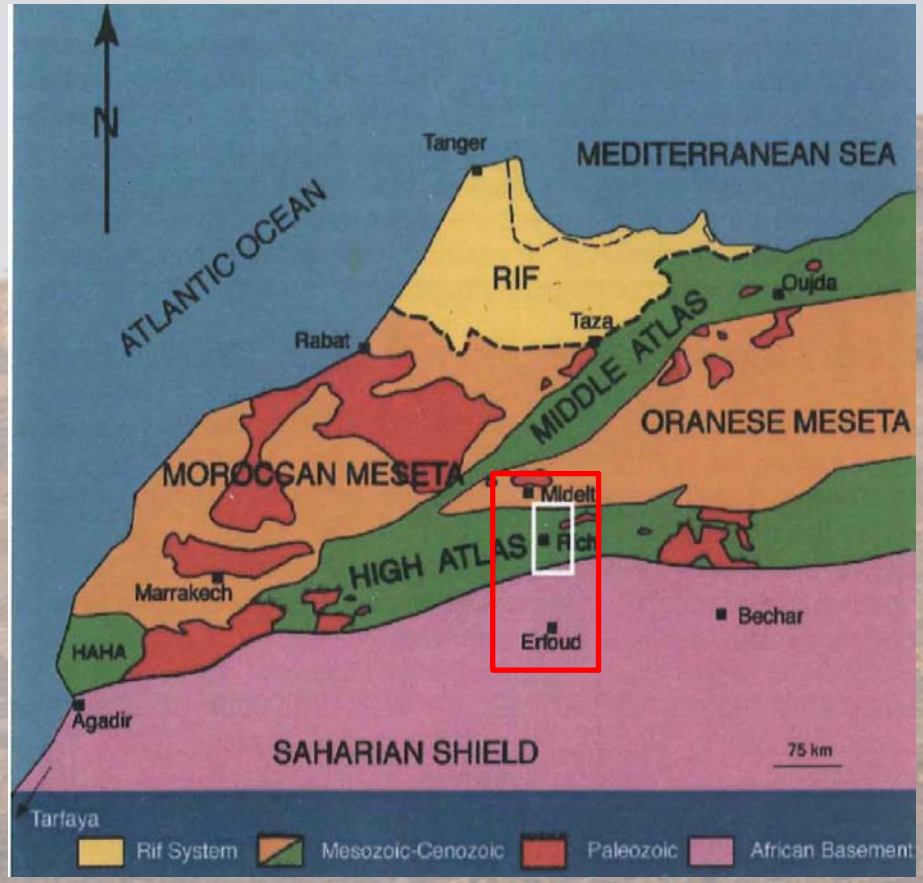
- Carbonate mounds are morphological features formed through complex interactions between biological and geological processes under suitable hydrodynamic conditions
  - The composition of the mound deposits varies
    - Coral
    - Bryozoans
    - Sponges
    - Algal-bacterially mediated mud mounds

Mound initiation



From Roberts et al., 2009

Maps of Morocco



Recent mounds on the Morrocan margin

Presentation by Dierk Hebbelen, MARUM

- Atlantic margin:
  - Smaller than other known Atlantic coral mounds
  - Found at 500 to 1000 m water depth
  - Only growth during last glacial period, now all dead and only „coral graveyards“ present
- Mediterranean margin:
  - Both mounds and ridges
  - Found at 200 to 400 m water depth
  - Alive coral framework growth continued after a long period of now growth approx. 14 kyr ago.
- Reason:
  - Ocean productivity, at time beeing insufficient to support large coral frameworks at the Atlantic margin

Ancient carbonate mounds in Morocco

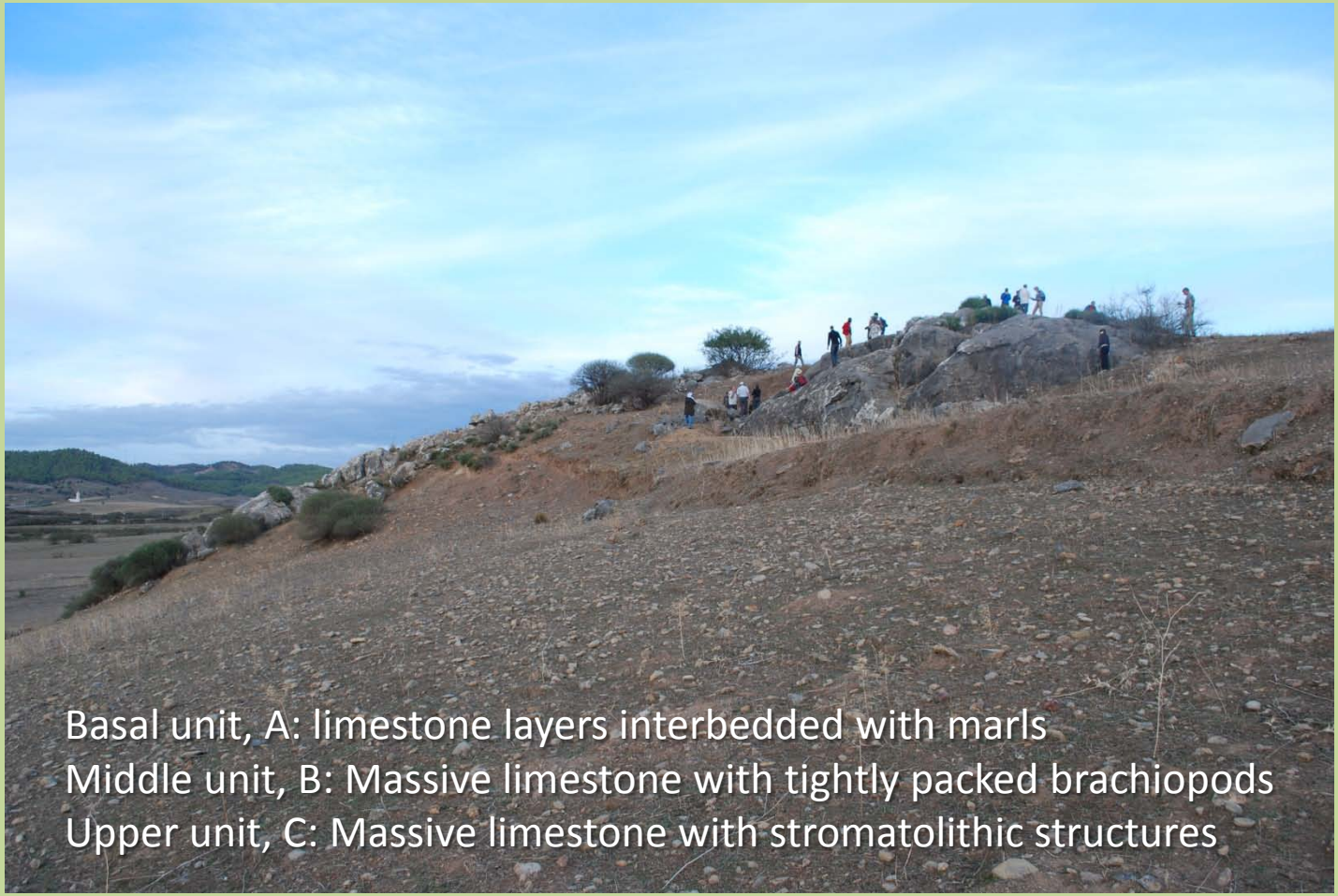
- The Upper Ordovician carbonate mounds and associated deposits of Anti-Atlas
- The Silurian mound from Meseta domain, Middle Atlas
- Devonian carbonate mounds from Anti- and Middle Atlas
- Carboniferous biogenic mounds of Hammou Ghannem
- The Jurassic carbonate mounds from central High Atlas

The Upper Ordovician carbonate mounds and associated deposits of Anti-Atlas

Bryozoan biostrome

Saharan icesheet

The Silurian mound from Meseta domain, Middle Atlas

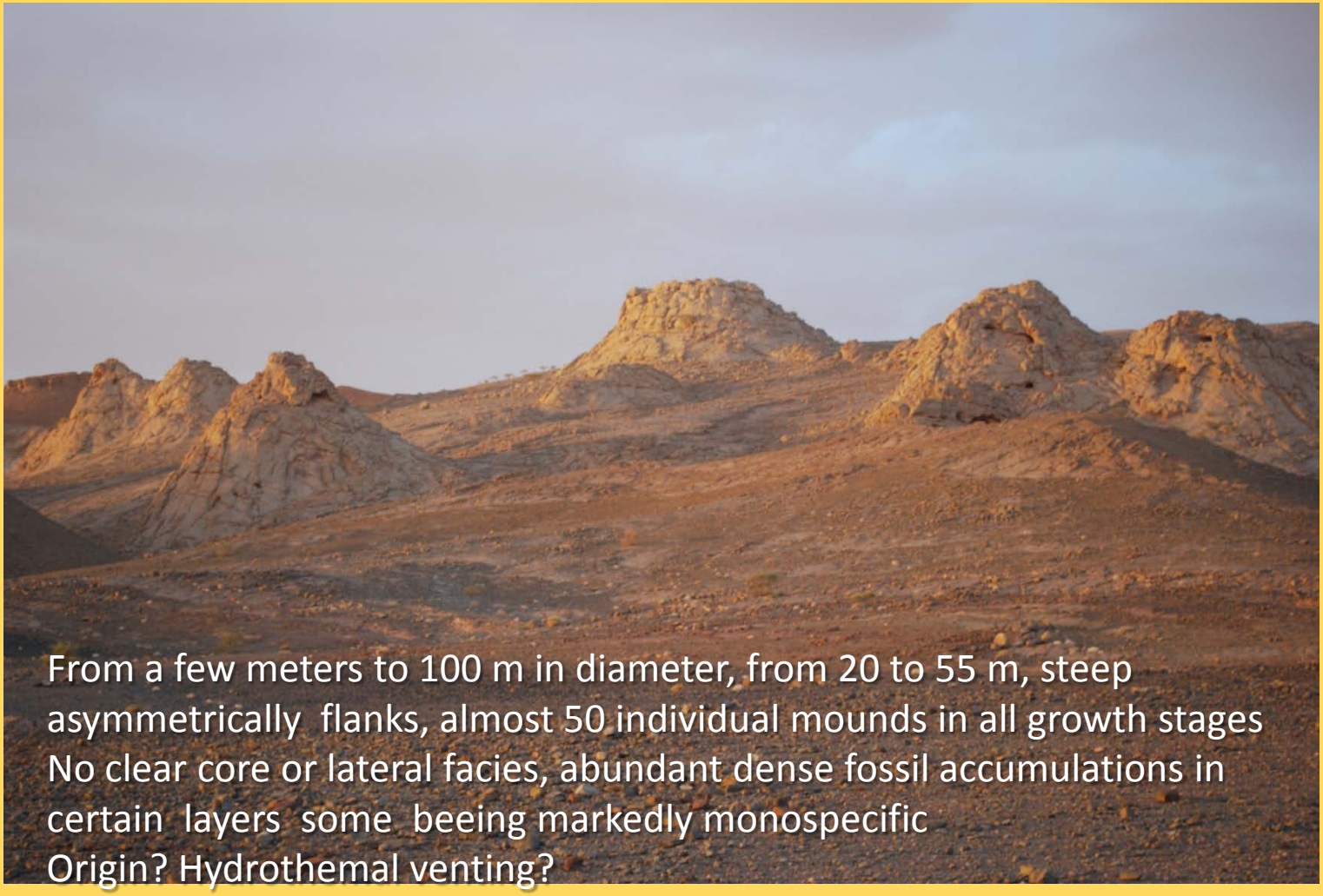


Oldest known fossil cold-seep ecosystem

Monospecific chemosymbiotic brachiopods

Stromatolithic structures

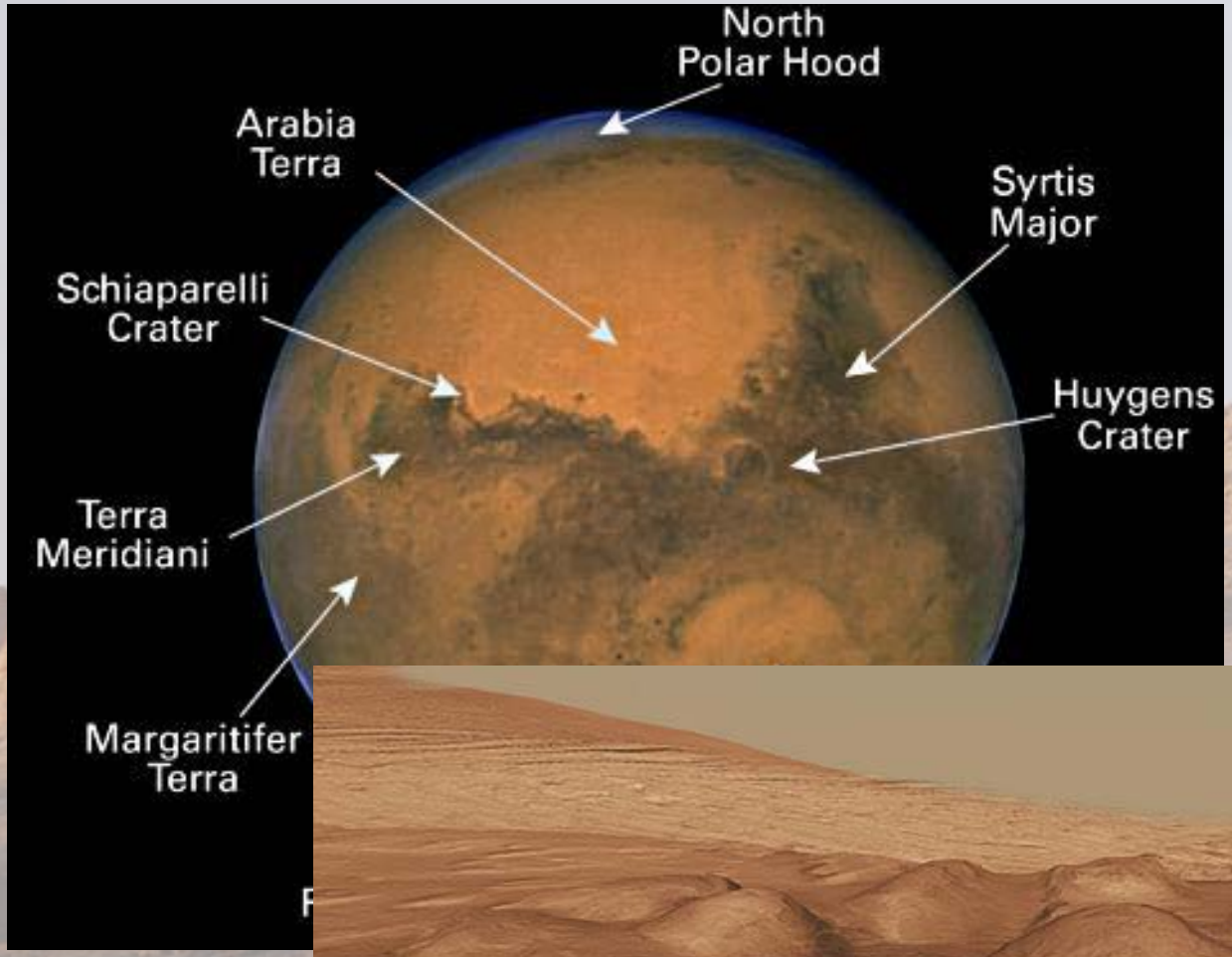
Kess Kess mounds (early Devonian)

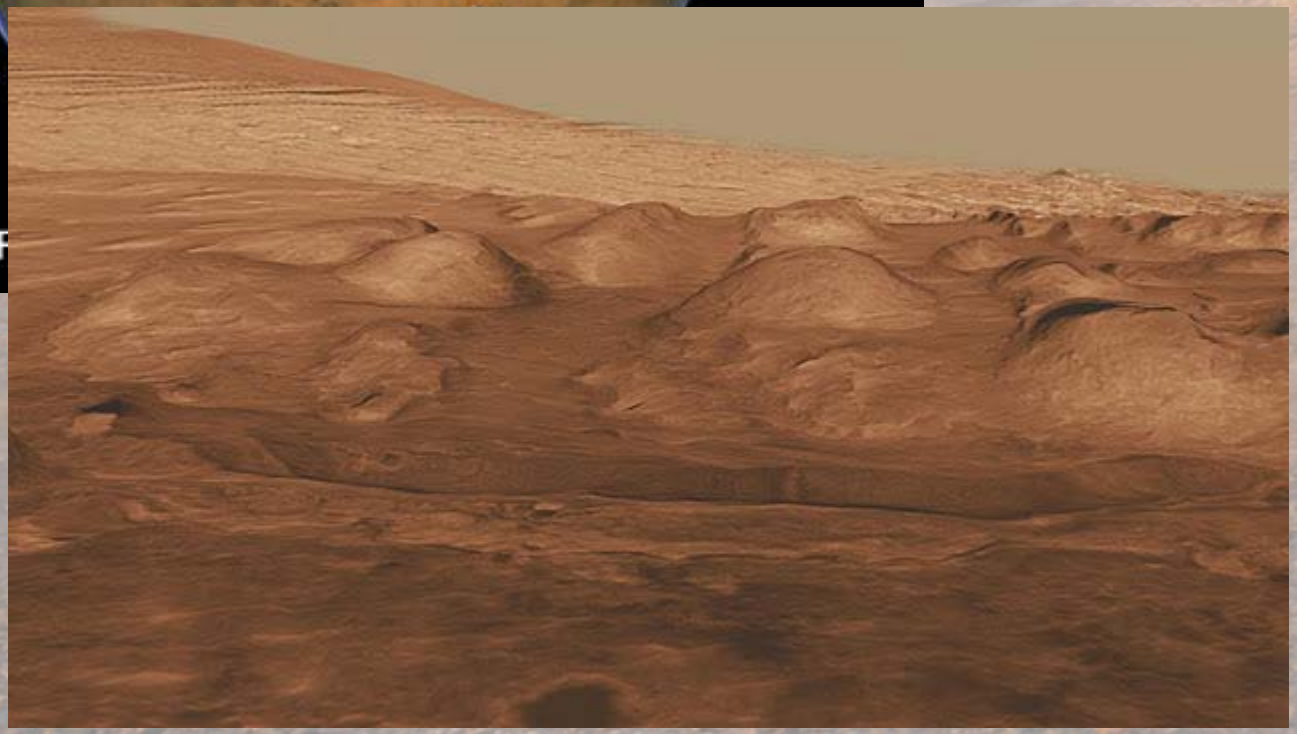


From a few meters to 100 m in diameter, from 20 to 55 m, steep asymmetrically flanks, almost 50 individual mounds in all growth stages
No clear core or lateral facies, abundant dense fossil accumulations in certain layers some beeing markedly monospecific
Origin? Hydrothemal venting?

Devonian carbonate mounds from Anti- and Middle Atlas

Origin? Hydrothermal venting


North
Polar Hood
Arabia
Terra
Syrtis
Major
Schiaparelli
Crater
Huygens
Crater
Terra
Meridiani
Margaritifer
Terra

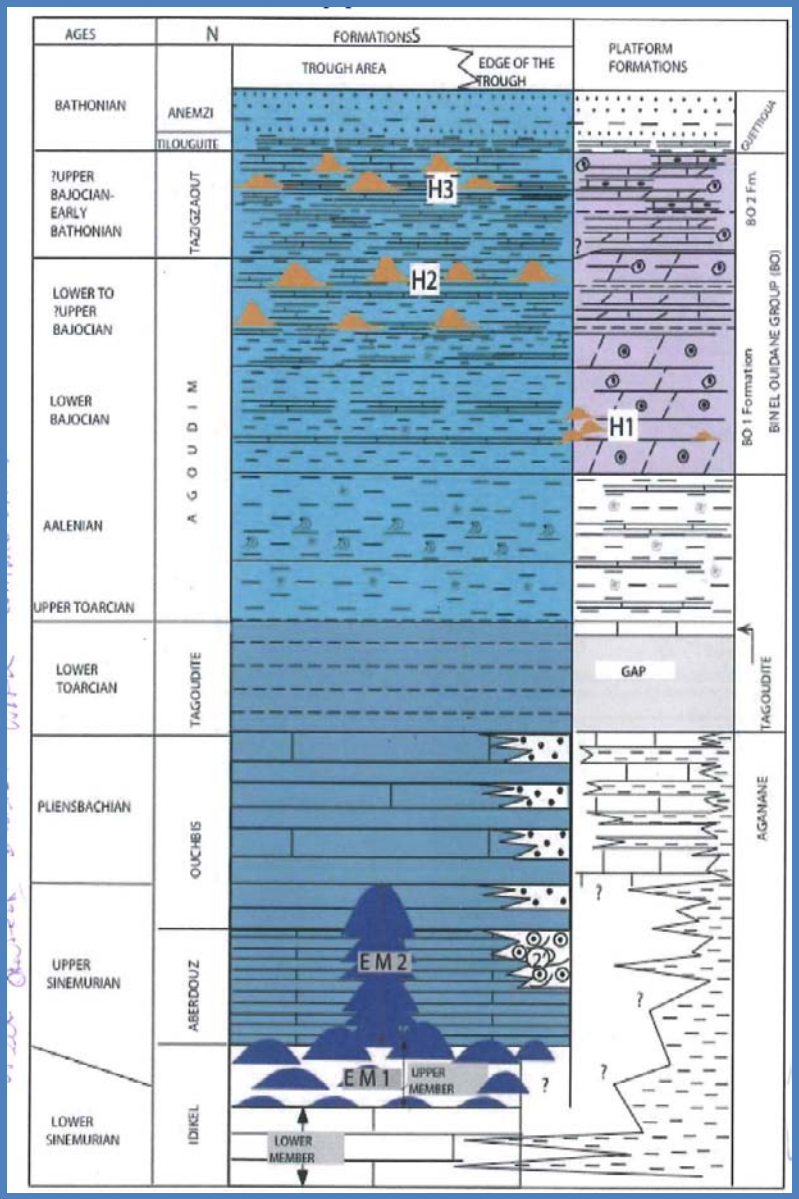


Carboniferous biogenic mounds of Hammou Ghannem

Corefacies: massive limestone, plenty crinoids, live position, few corals in the base, stromatactics
Flanks: Layers with prefered orientation, fewer crinoids, less diagenetic, no onlap
Intepretation: First large corals and crinoid, growing fast, the flanks grow at the same time (slow)

The Jurassic carbonate mounds (central High Atlas)

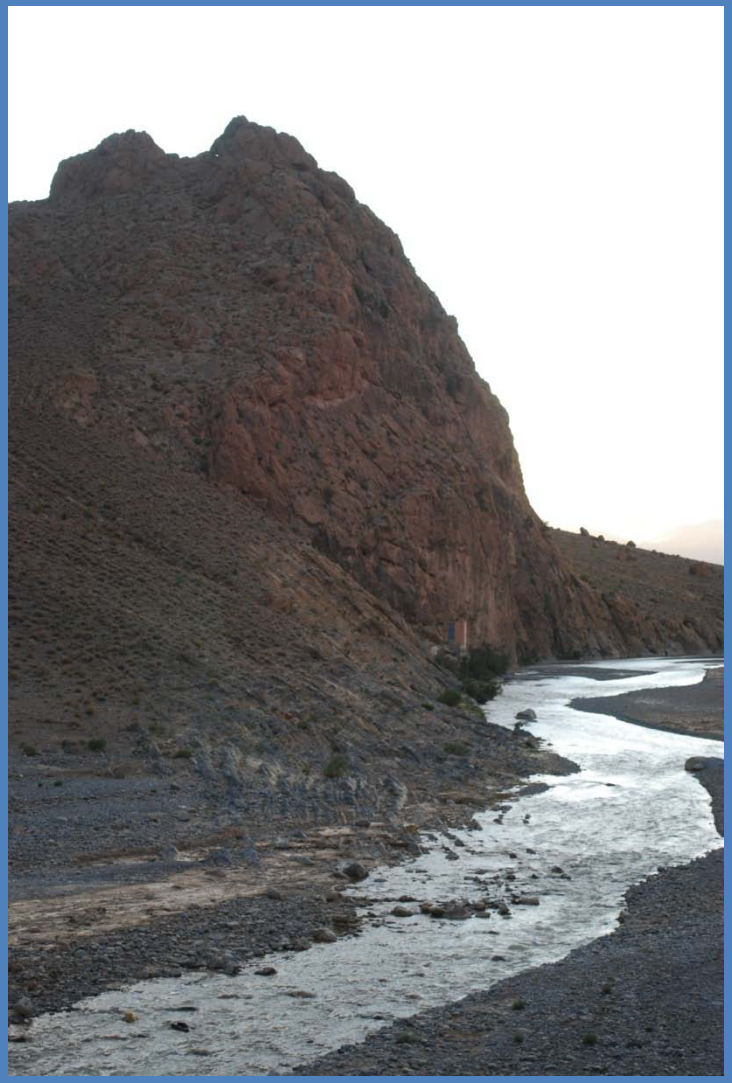
Basin



Platform conditions
Patch reefs

Platform conditions,
Spongerich mudmounds

Jurassic spongerich mudmounds



Jurassic patch reefs

Sum up ancient carbonate mounds in Morocco

Hydraulic origin

- The Silurian carbonate mound
- Devonian carbonate mounds?

Environmental origin

- The Upper Ordovician carbonate bryozoan mounds
- Carboniferous biogenic mounds
- The Jurassic biogenic mounds

Thanks to ESF and to the organizers of CoCaRDE

And to all the participants.....