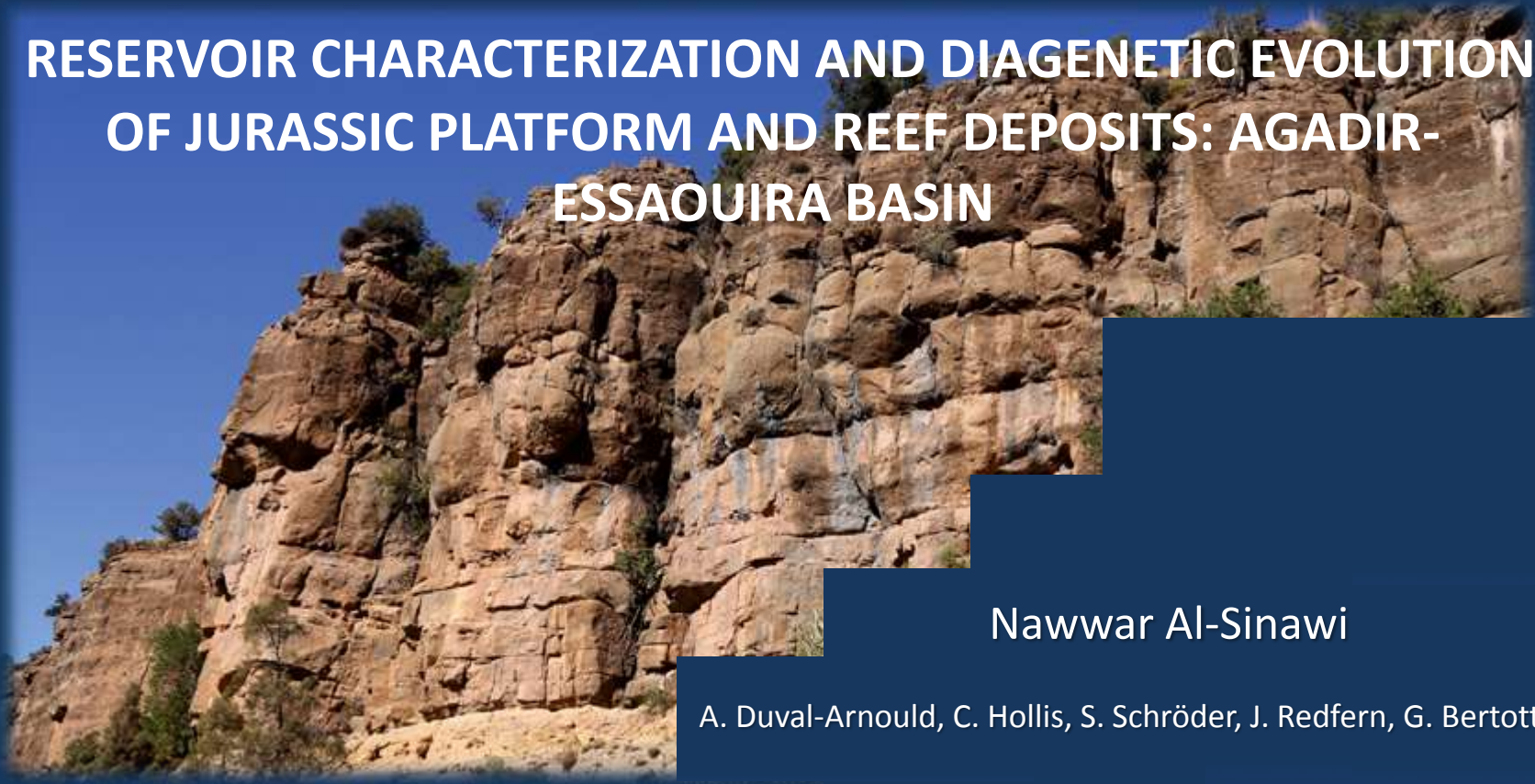


RESERVOIR CHARACTERIZATION AND DIAGENETIC EVOLUTION OF JURASSIC PLATFORM AND REEF DEPOSITS: AGADIR- ESSAOUIRA BASIN

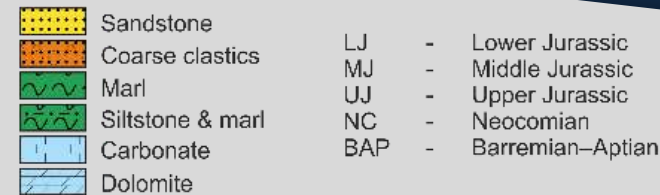


Nawwar Al-Sinawi

A. Duval-Arnould, C. Hollis, S. Schröder, J. Redfern, G. Bertotti

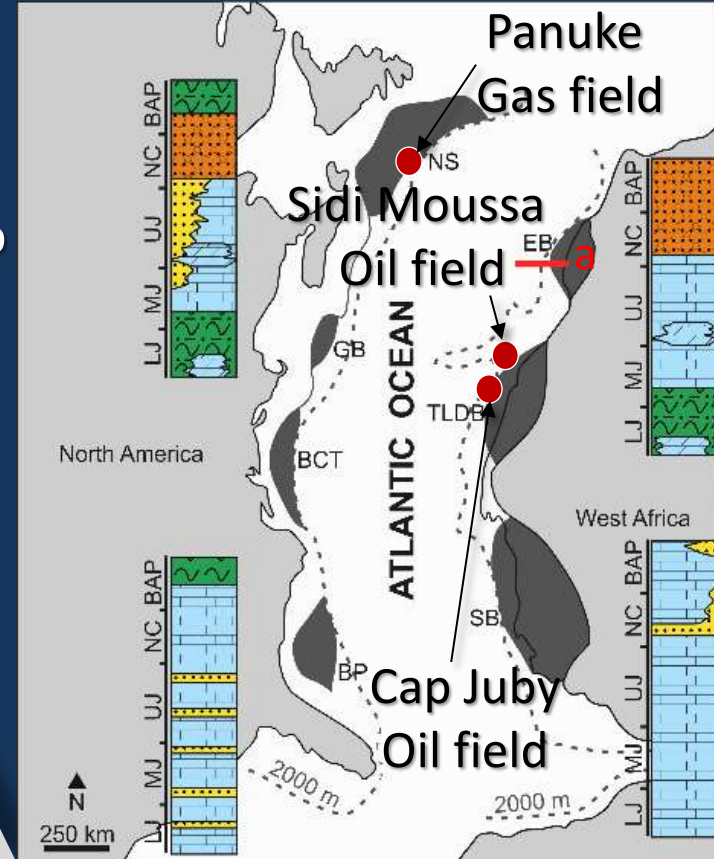
AIMS AND OBJECTIVES

- Determine dolomite distribution, controls & origin
- Assess dolomitization impact on reservoir quality
- Log & map the dolomite, asses its stratal relationship
- Describe petrographically and geochemically

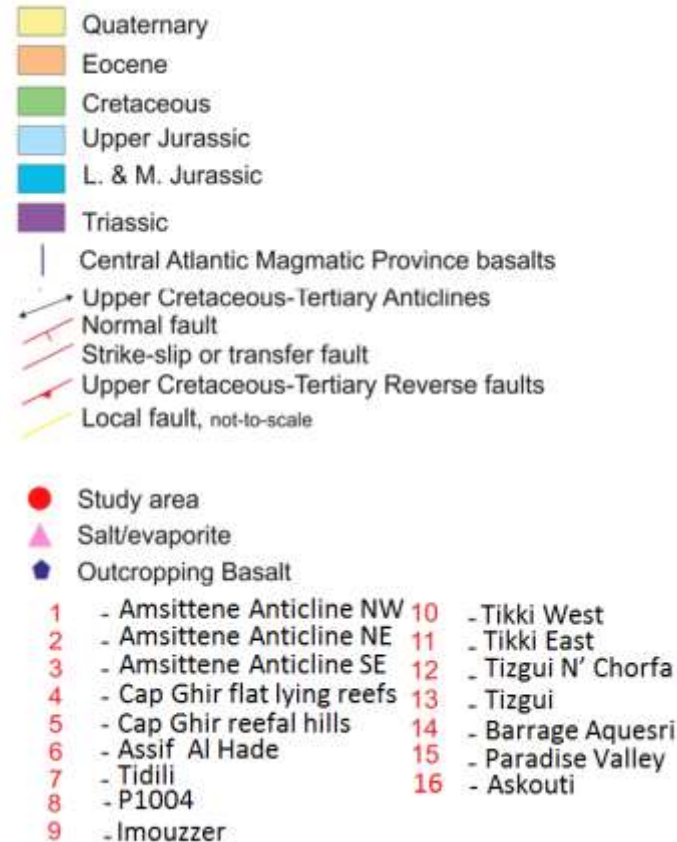
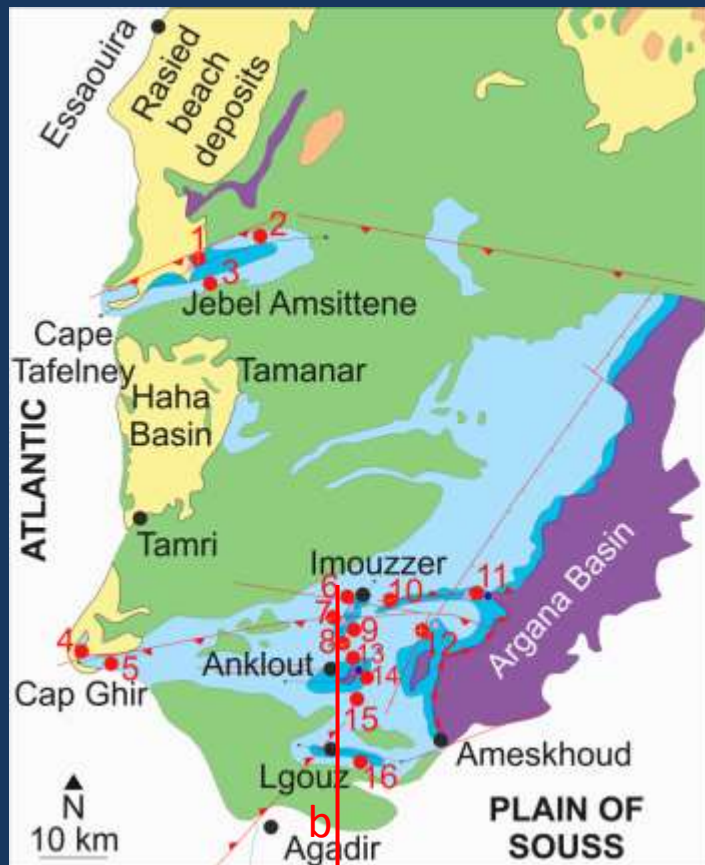
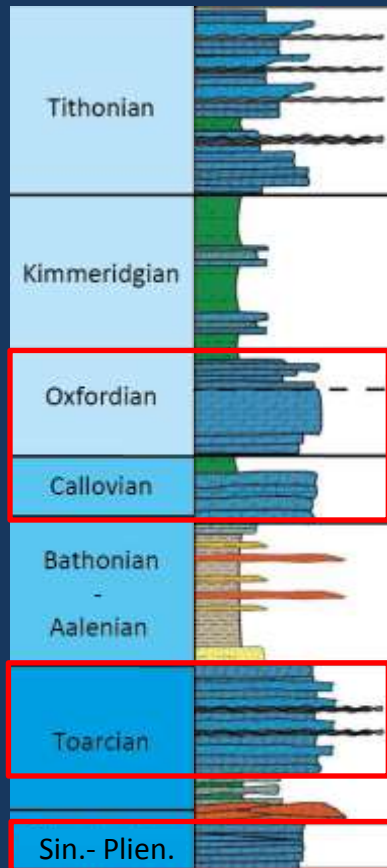


- | | | |
|------|---|-------------------------------|
| BP | - | Blake Plateau |
| BCT | - | Baltimore Canyon trough |
| GB | - | Georges Bank |
| NS | - | Nova Scotia |
| EB | - | Essaouira Basin |
| SB | - | Senegal Basin |
| TLDB | - | Tarfaya Laayoune Dakhla Basin |

Central Atlantic Basins
(modified after Leprêtre et al. 2017)

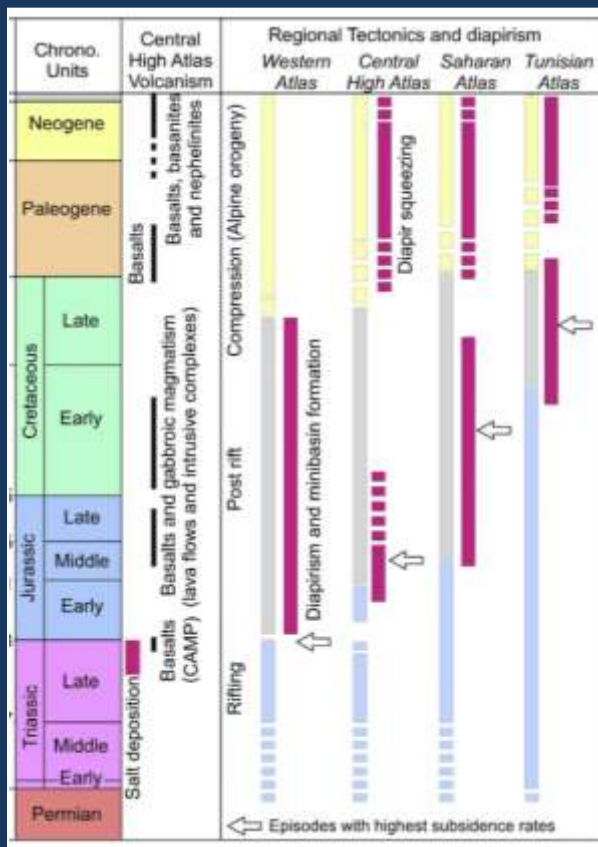


ESSAOUIRA – AGADIR BASIN

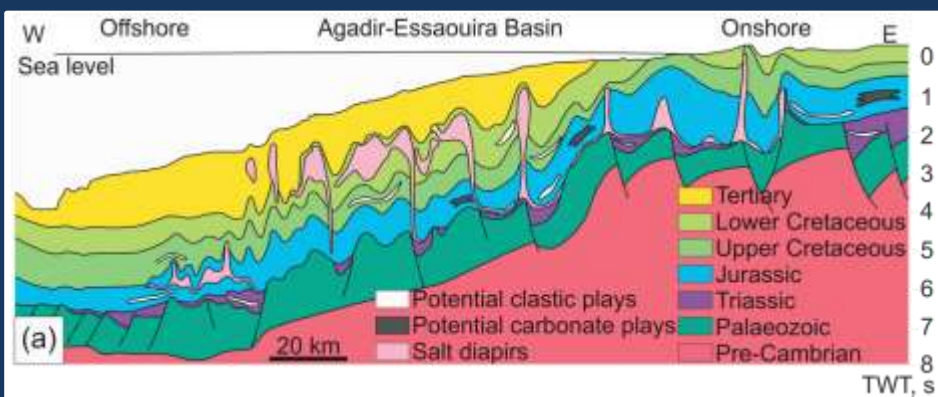


Modified after Ager (1974a), Mustaphi et al. (1997), Zuhlke et al. (2004), Hafid et al. (2006), Frizon de Lamotte et al. (2008), Bertotti & Gouiza, 2012

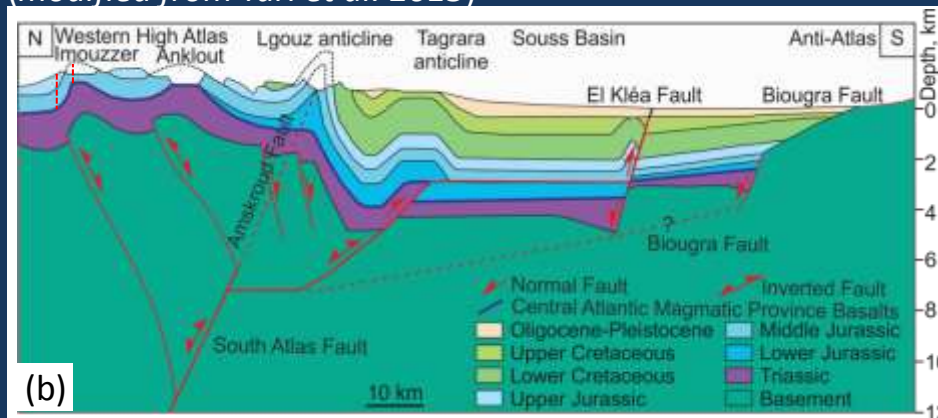
ESSAOUIRA – AGADIR BASIN



(from Vergés, et al. 2017)



(modified from Tari et al. 2013)



(modified from Frizon de Lamotte et al. 2008)

SINEMURIAN DOLOMITIZATION

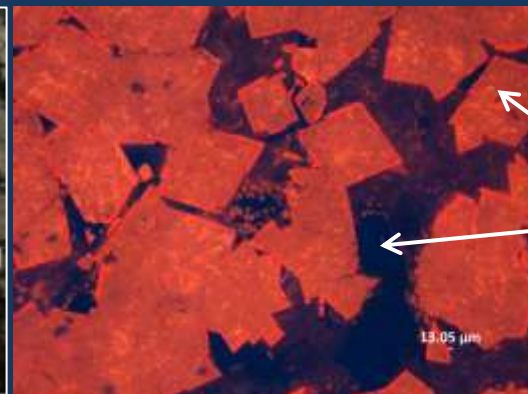


Stratabound dol.:

- Oncoid WST
- Oolitic-Pel. PST
- MST.

Poroperm:

HL: 0.4%, 0.2mDarcy
RD: 11%, 0.9mDarcy



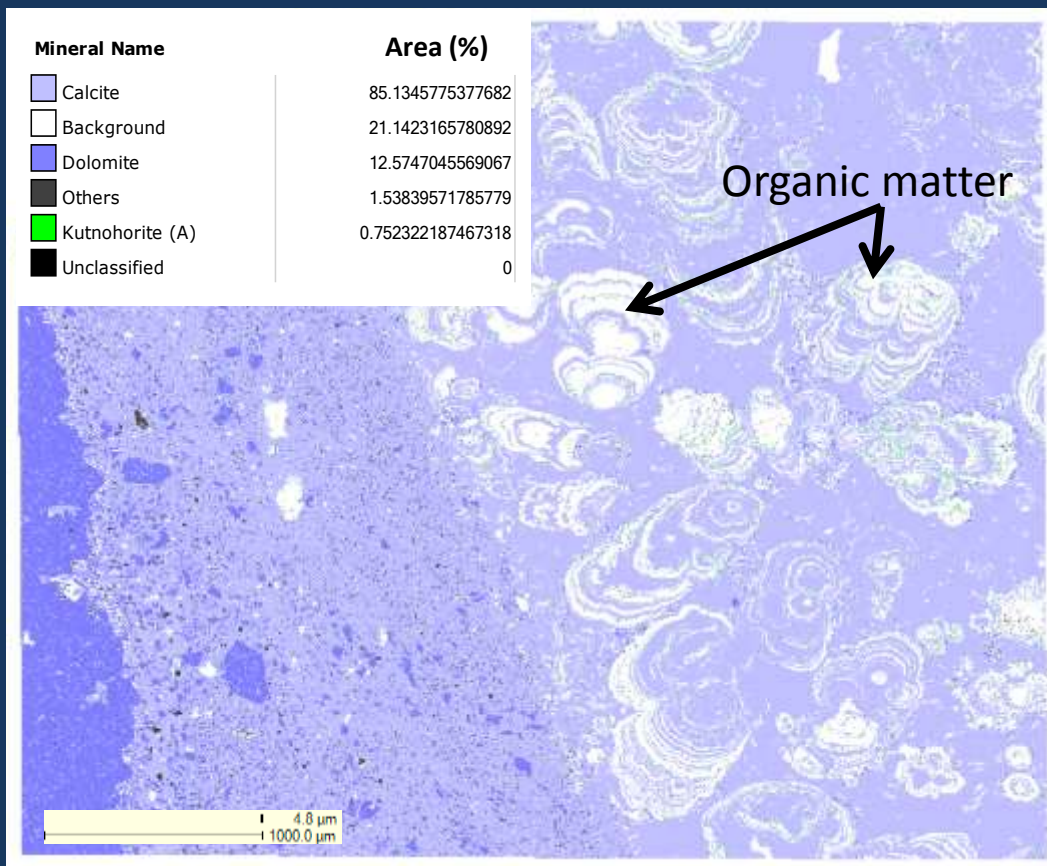
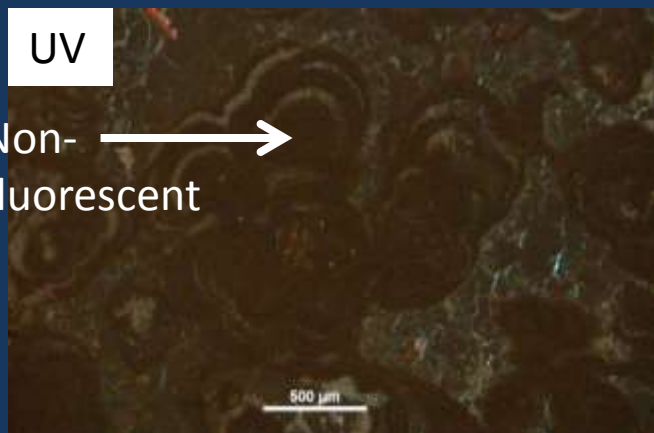
Isotopes:

RD: -2.84 to -4.09 $10^3 d^{18}O_{VPDB}$ } Close to
 RD: 0.34 to 2.11 $10^3 d^{13}C_{VPDB}$ } Jur. sea water

CC: -4.22 to -5.25 $10^3 d^{18}O_{VPDB}$ } Met. Water
 CC: -8.62 to -10.07 $10^3 d^{13}C_{VPDB}$ } +Bitumen?

HL: 69.5C° } Clumped isotopes
 RD: 65.5 & 90 C° }

SINEMURIAN DOLOMITIZATION



SINEMURIAN DOLOMITIZATION



Dolomitization of salt surrounding units

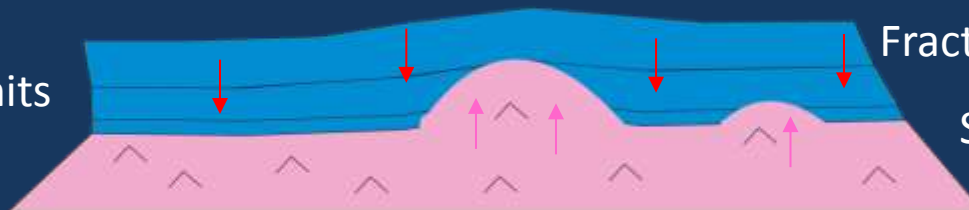
Dol. Breccia



Dol. Of permeable layers

Dissolution of Mg^{2+} rich salts by freshwater or enhanced by seawater circulation

Overburden of overlying units



Fracturing

Salt diapirism

Lower Jurassic carbonates

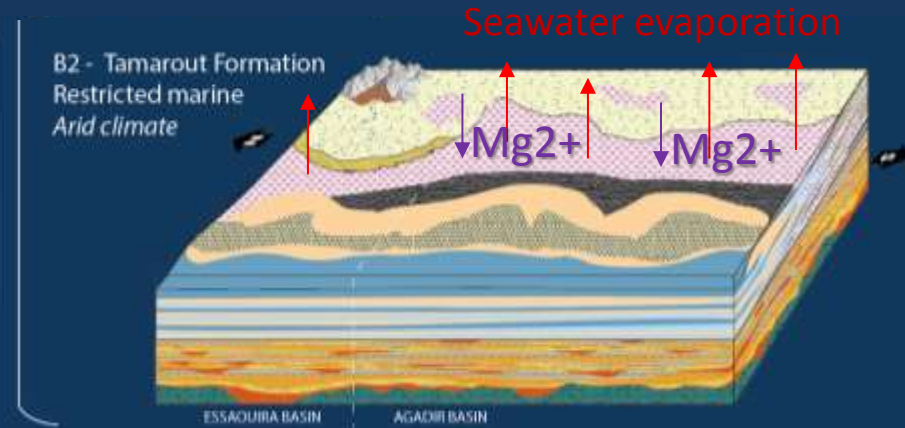


Triassic salt

TOARCIAN DOLOMITIZATION



Barrage Aquesri



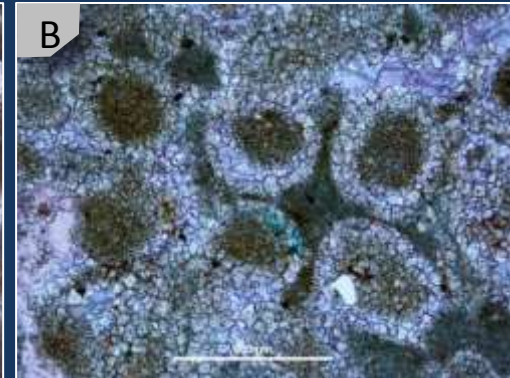
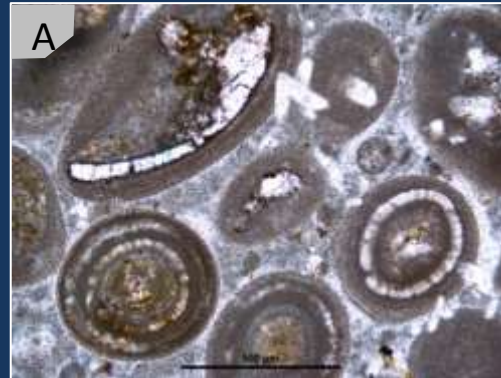
Stratabound dolostones:

- MST
 - Oolitic and peloidal W/PST
 - Oolitic GST
 - Stromatolites
- + dissolution breccia

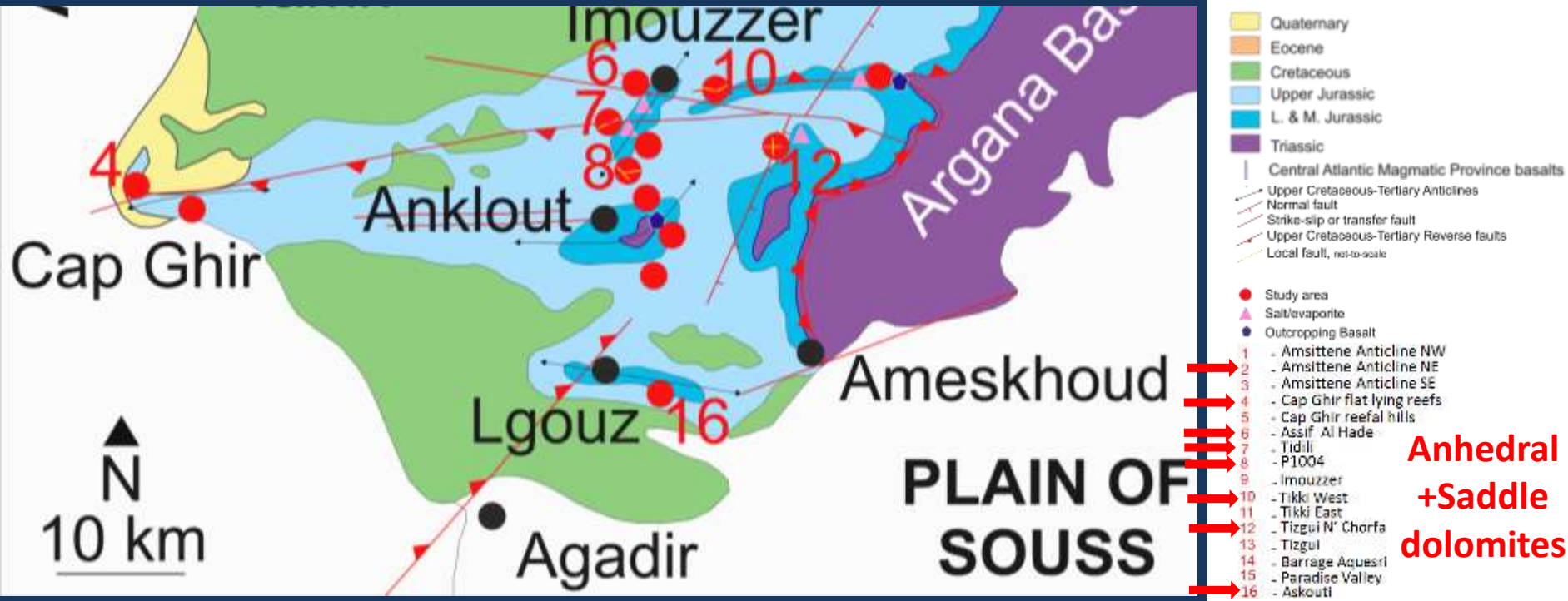
Poroperm:

HL: 6.9%, 0.1mDarcy
RD: 9%, 0.1mDarcy

Isotopes: $\left. \begin{array}{l} \text{RD: } 0.60 \text{ to } 0.83 \text{ } 10^3 \text{d}^{18}\text{O}_{\text{VPDB}} \\ \text{RD: } 3.83 \text{ to } 3.86 \text{ } 10^3 \text{d}^{13}\text{C}_{\text{VPDB}} \end{array} \right\} \text{Sabkha}$



BASIN SCALE STRUCTURAL OVERVIEW

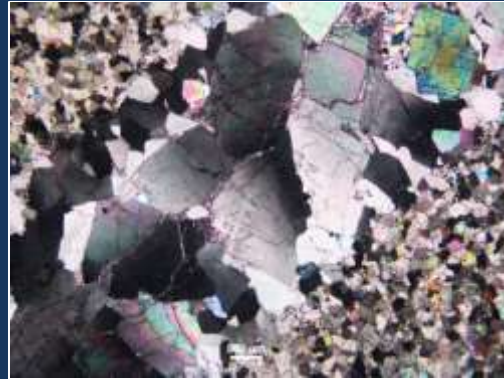


Modified after Ager (1974a), Mustaphi et al. (1997), Zuhlke et al. (2004), Hafid et al. (2006) and Frizon de Lamotte et al. (2008)

OUTCROP SCALE STRUCTURAL OVERVIEW



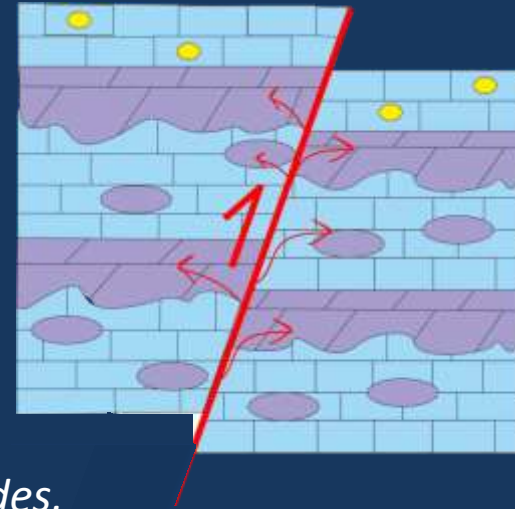
OXFORDIAN DOLOMITIZATION



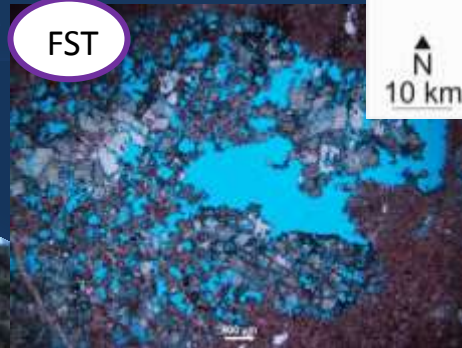
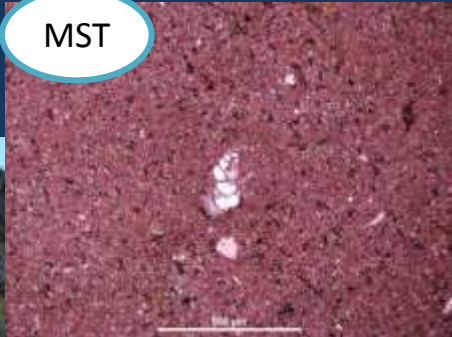
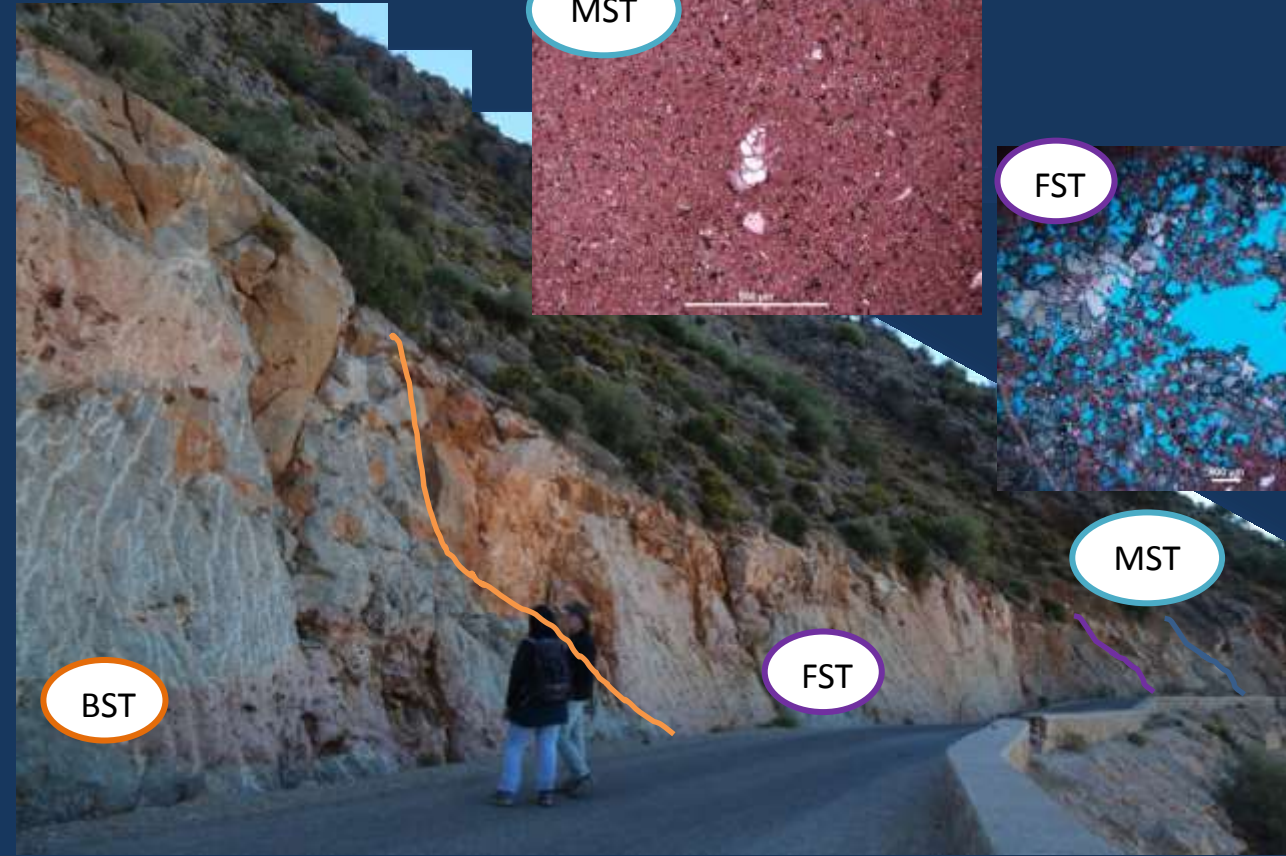
Bioclastic RST
Heavily frac.



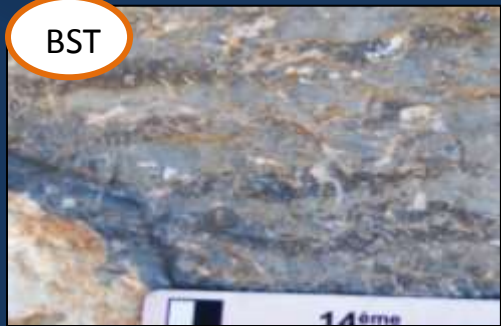
Brach.,
Isolated
branching
corals,
Thalassinoides,
FLT-RST



OXFORDIAN DOLOMITIZATION



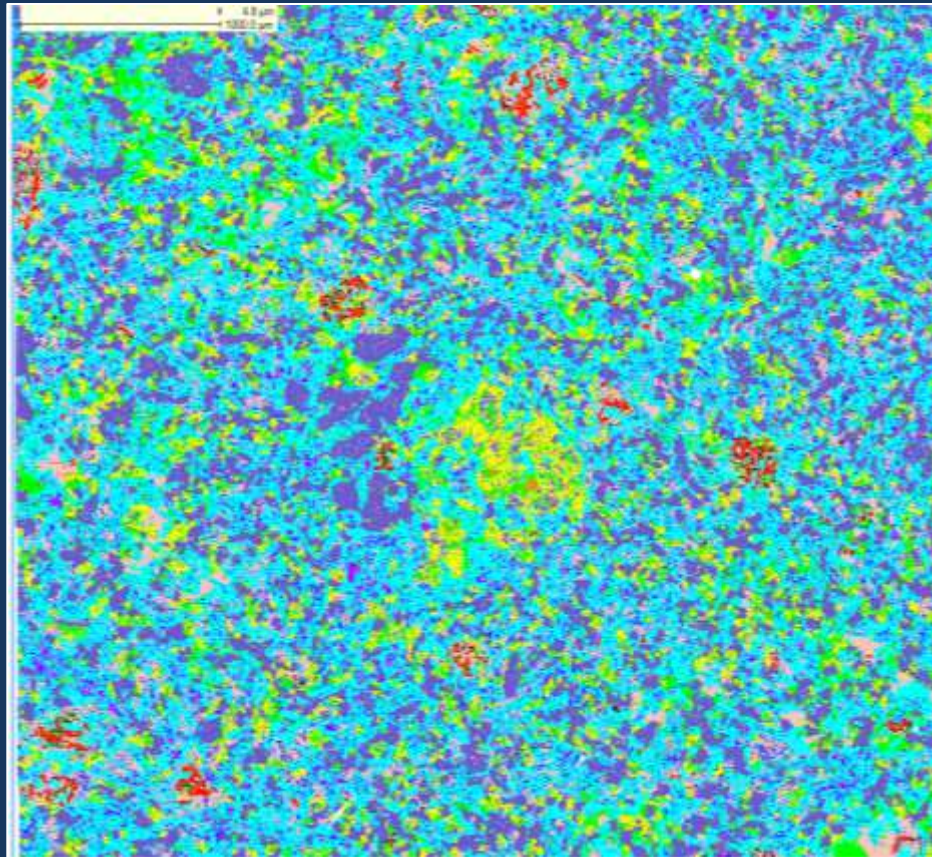
Poroperm:
HL: 2-5%, 0.1-0.4mDarcy
D: 2-8%, 0.01-3.2mDarcy
Isotopes:
HL: 79oC
D: 117-139oC



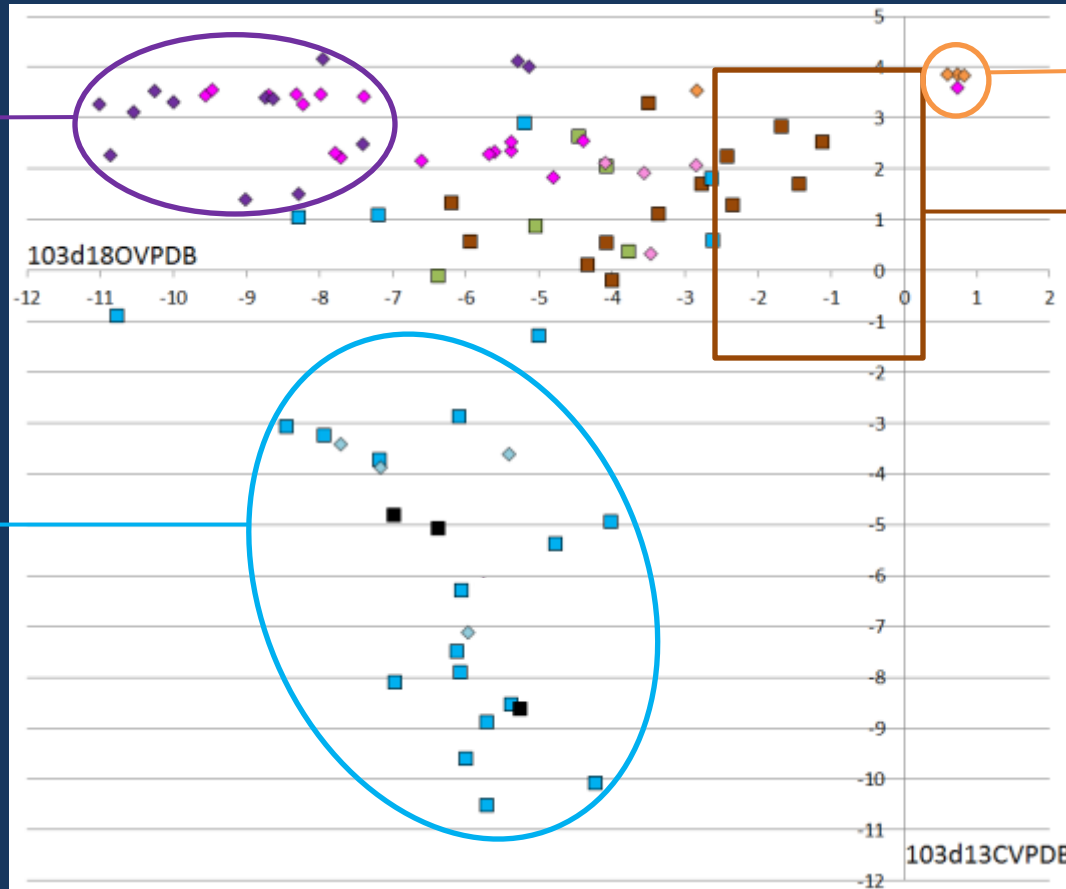
CAMP BASALT



Mineral Name	Σ	AreaPercent(Mineral)
Feldspar		38.8659245200944
Pyroxene		21.0324360668661
Olivine		7.21627687962807
Chlorite		10.5456135295462
Quartz		7.88583175729312
Illite		4.66049720066553
Mica		3.27694918360565
Kaolinite (A)		0.566104812470535
Titanite (A)		0.471928819289187
Rutile (T)		0.53430799413967
Siderite-Quartz (75:25) (R)		0.459894606795907
Apatite (T)		0.329008745229097
Ilmenite (A)		0.192657805511669
Fe Oxides		0.142036829106454
Fe-Ti Ox (T)		0.136737359384643
Others		1.96886340727198
Background		0.201655863476828
Unclassified		0
Epoxy - Particle Edge		0
Low CR		1.71493048310187
Unclassified		0



Jurassic Carbonates Isotopes



Sabkha/ marine hypersaline lagoon dol. Toarcian

Jurassic marine carbonate material

- Limestone
- Microsparite partly replacing limestone
- Calcite cement
- Black calcite cement
- ◆ Dedolomite replacing matrix
- ◆ Microcrystalline/ euhedral replacing dolomite
- ◆ Subhedral replacing dolomite
- ◆ Anhedral replacing/ cementing dolomite
- ◆ Saddle replacing/ cementing dolomite

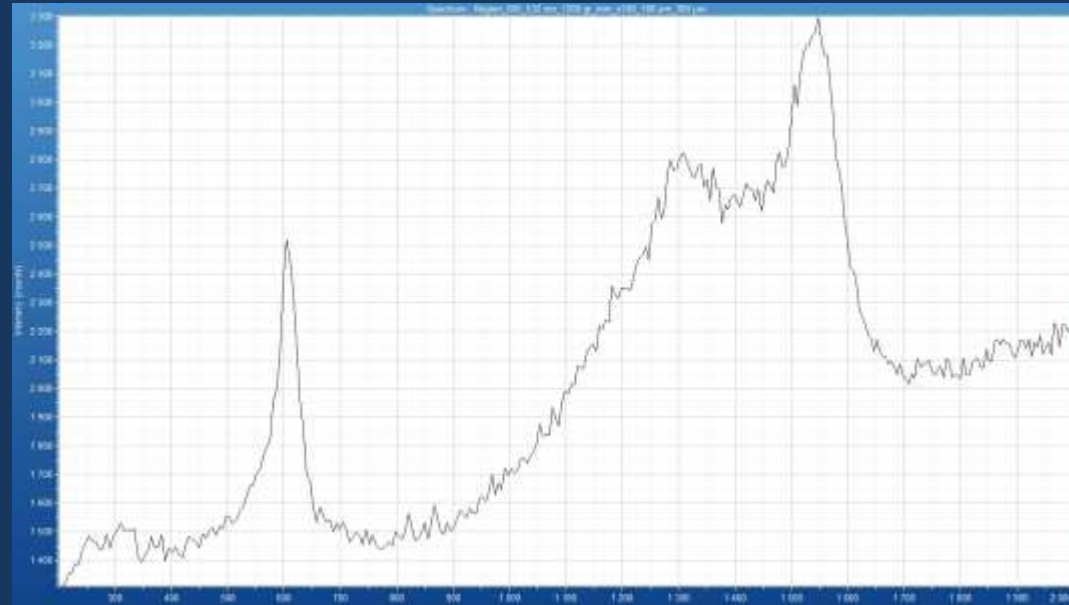
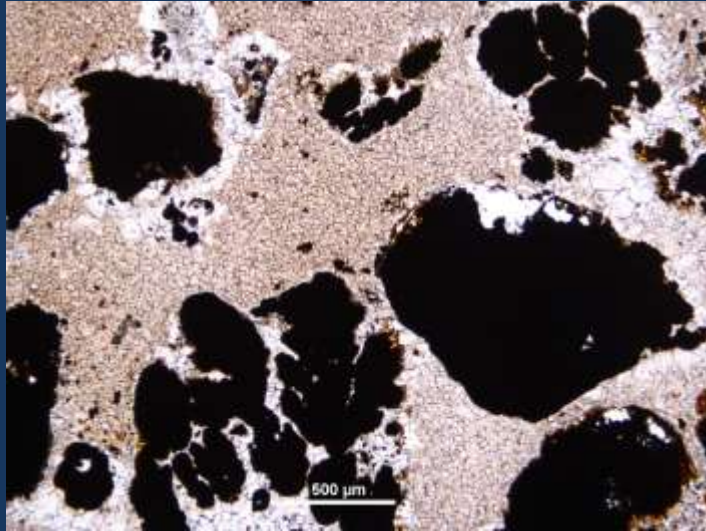
Deep burial
High temp. dol
Callovian- Oxfordian

Includes calcitized dol.
Non-luminescent
Meteoric water
Associated with bitumen?

Related to uplift/
subaerial exposure

d18O vs d13C plot of Jurassic host limestones and diagenetic fluids phases

Jurassic HC



CONCLUSIONS

- Lower Jurassic dolostones are stratabound and laterally extensive
- Middle- Upper Jurassic dolostones are stratabound and non-stratabound, occur in close vicinity to faults
- Euhedral-subhedral Sinemurian dolomites sourced from salt diapir dissolution?
- Euhedral- anhedral *Toarcian* dolomites sourced from seawater reflux
- Anhedral- saddle *Callovian-Oxfordian* dolomites originated from **HT fluids** through **faults**
- Generally, dolomitization **enhanced porosity** of parent limestone
- Calcitization **occluded** original porosity created during dolomitization

THANK YOU FOR THE SUPPORT:



شركة تنمية نفط عُمان
Petroleum Development Oman



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Special thanks :

