TU Delft
Delft University of Technology

North Africa Research Group
www.narg.org.uk

mazarine energy

Permo-Triassic tectono-sedimentary systems in Central Tunisia and in adjacent regions: implications for hydrocarbons

Introduction and short terms plans for 2019-2020

Pierre-Olivier Bruna, Giovanni Bertotti, Salma Ben Amor and many others…

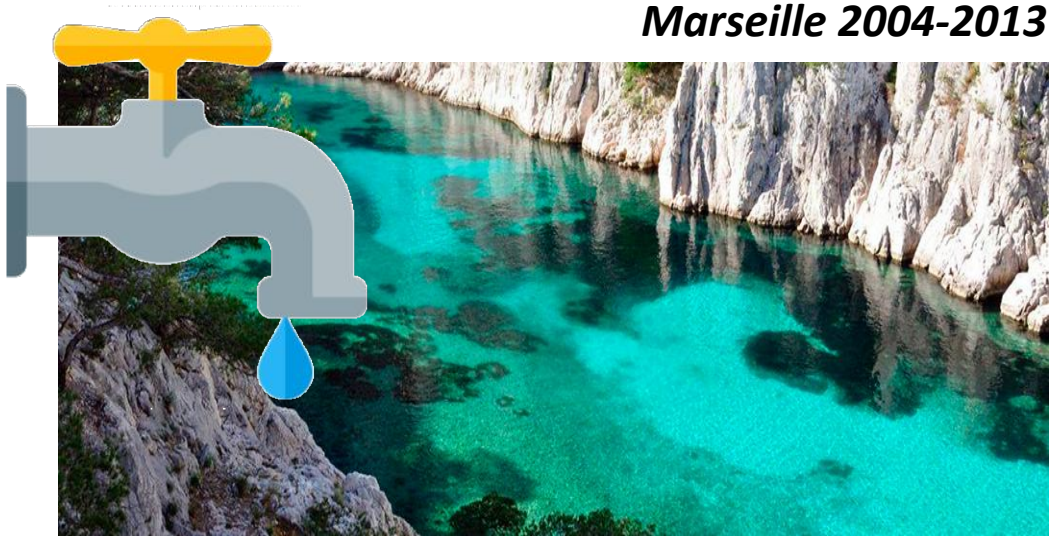
North Africa Research Group
Research and steering Committee Meeting
September, 18th, 2019

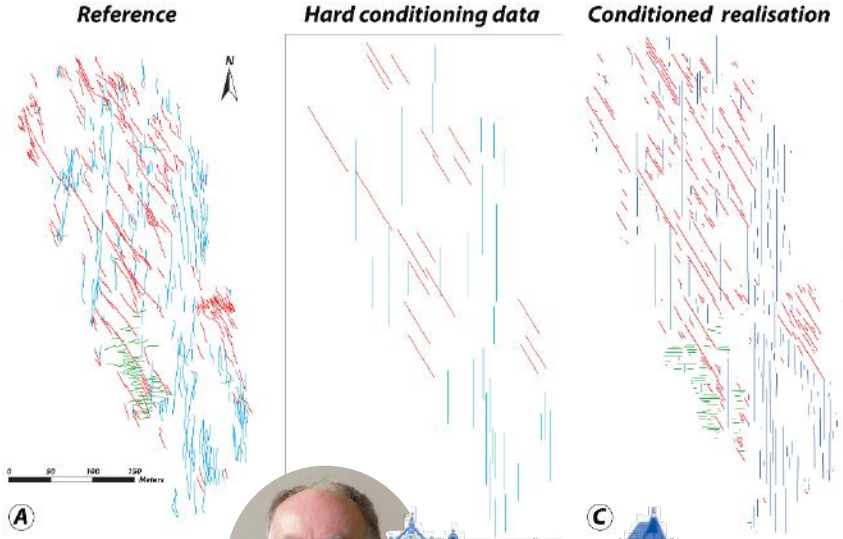
TU Delft Library
Blue Room

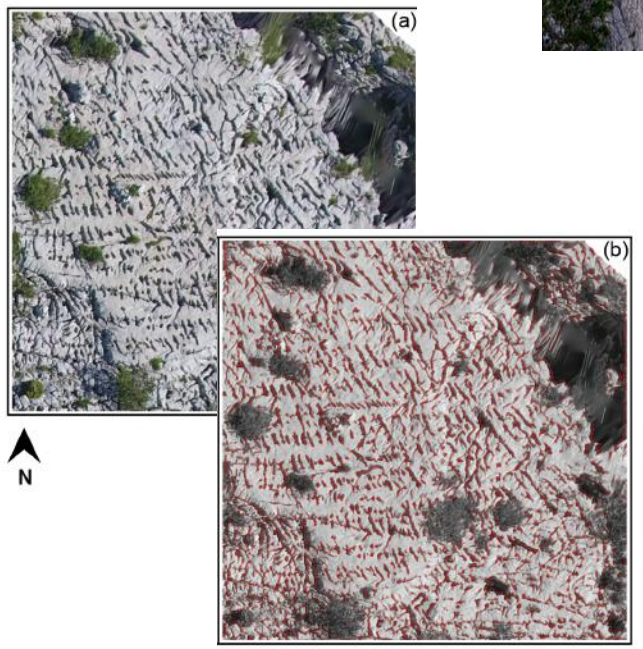
A bit of myself…

1986

Marseille 2004-2013



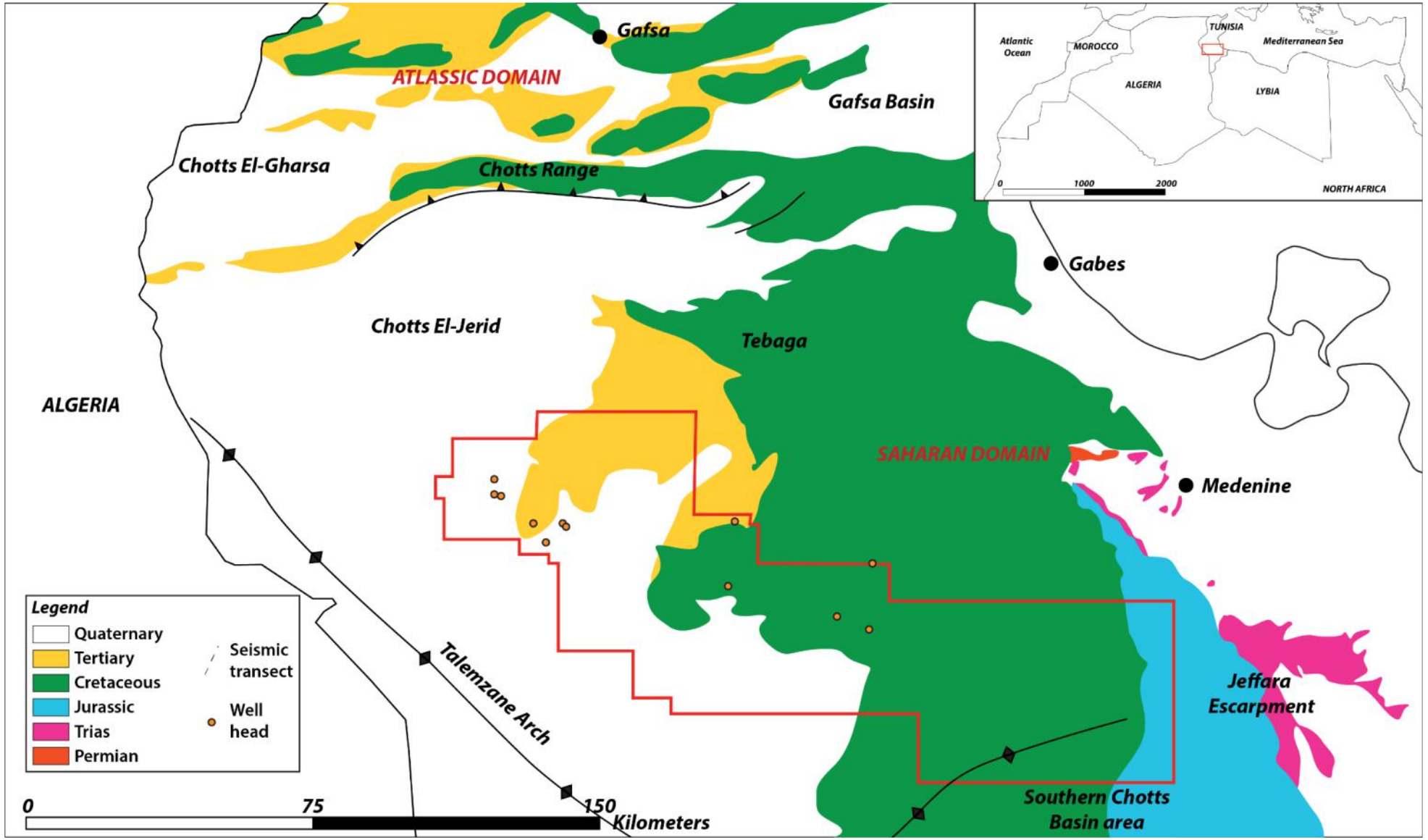




NT Australia geological survey 2013-2016

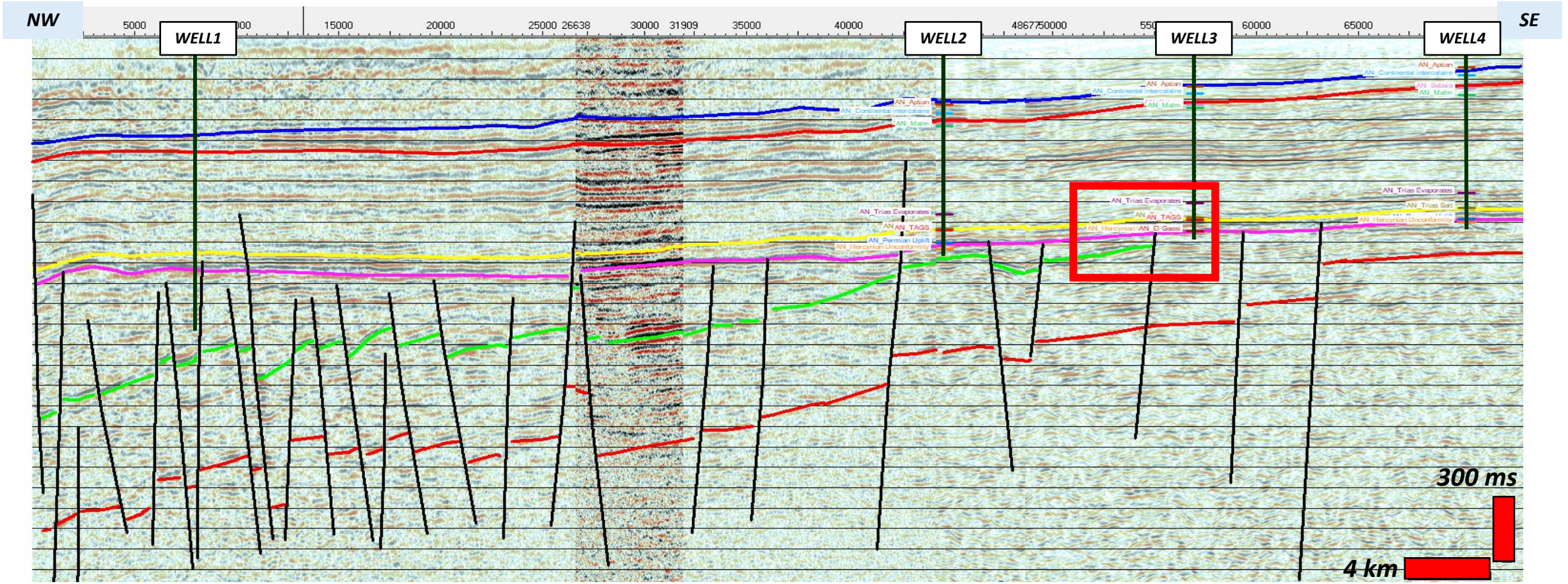
TU Delft

A collaboration with Mazarine Energy initiated in late 2018



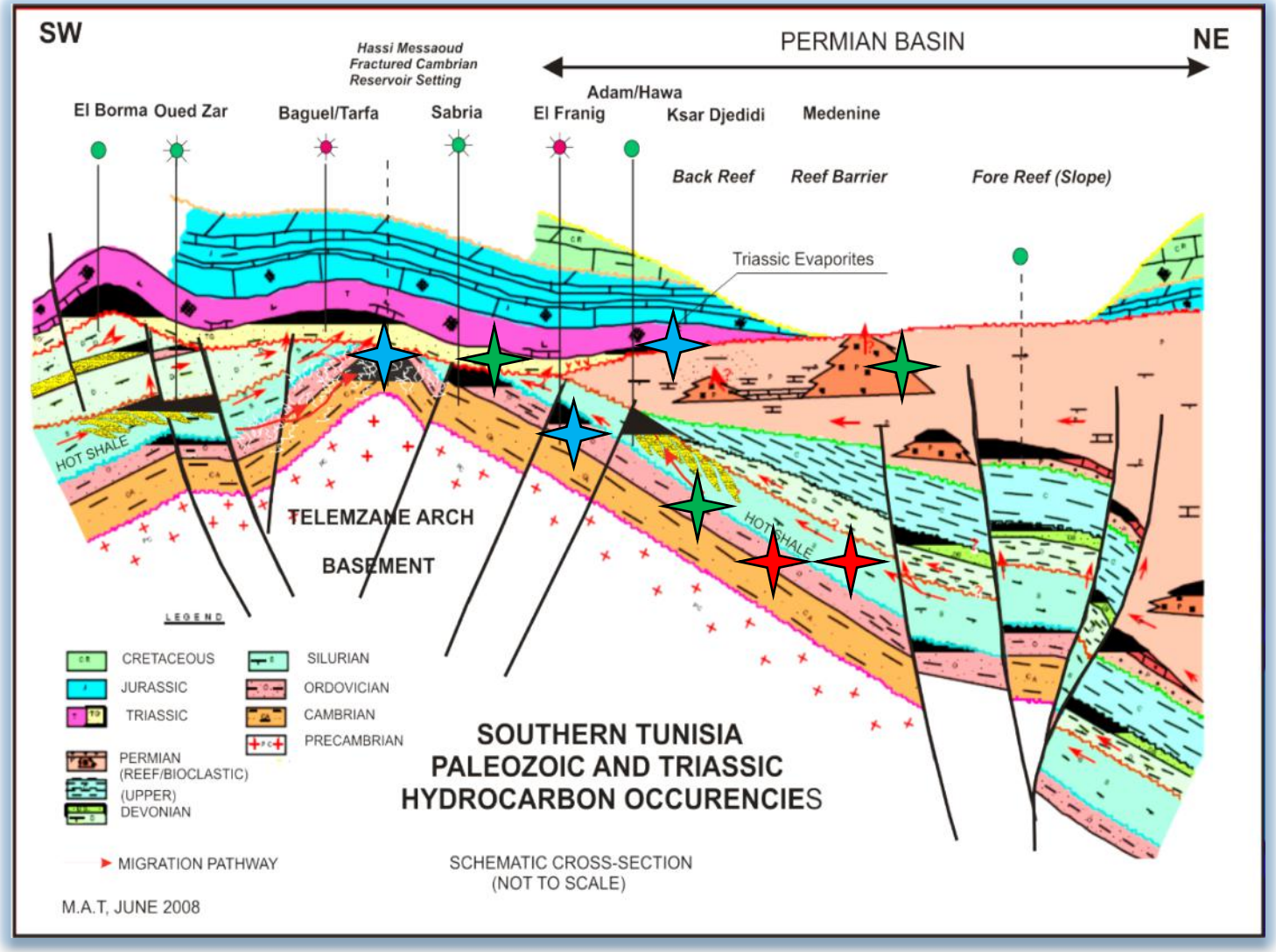
- Structural geology study of the Southern Chotts Basin (SCB), Central Tunisia
- Mazarine granted access to seismic, wells, geochemical analyses, sedimentology study and more, acquired in their blocks

Present-day architecture of the Southern Chotts Basin



- **Normal faulting with mainly small offsets**. Potential multi kilometers scale folding. Series of extension-compression phases - system of arch and basin
- **Angular unconformity** between at least the Silurian and the base Triassic.
- **Very “quiet” Mesozoic** sequence

Overview of the petroleum system in the Southern Chotts Basin



- Three main reservoirs (✦) = Ordovician Sandstone (Hamra, El Atchane, Jeffara); Triassic Sandstone (TAGI); Permian clastic and carbonates
- Source rock (✦) = Silurian–Devonian black shales and hot shales (Fegaguira); Ordovician shales (Azzel)
- Traps (✦) = structural (tilted blocks and anticlines) and stratigraphic (pinch out and channels)

"SMG-1 well flowed, constrained by surface facilities, at a rate of over 2,000 barrels of oil per day and 5 million cubic feet of natural gas per day" *(from Mazarine website - 2019)*

Objectives

- **Our NARG project objectives**

  - Increase our **understanding of the petroleum systems** in the SCB – thermal history, migration timing, sweet spots evaluation, type of flow in reservoirs…

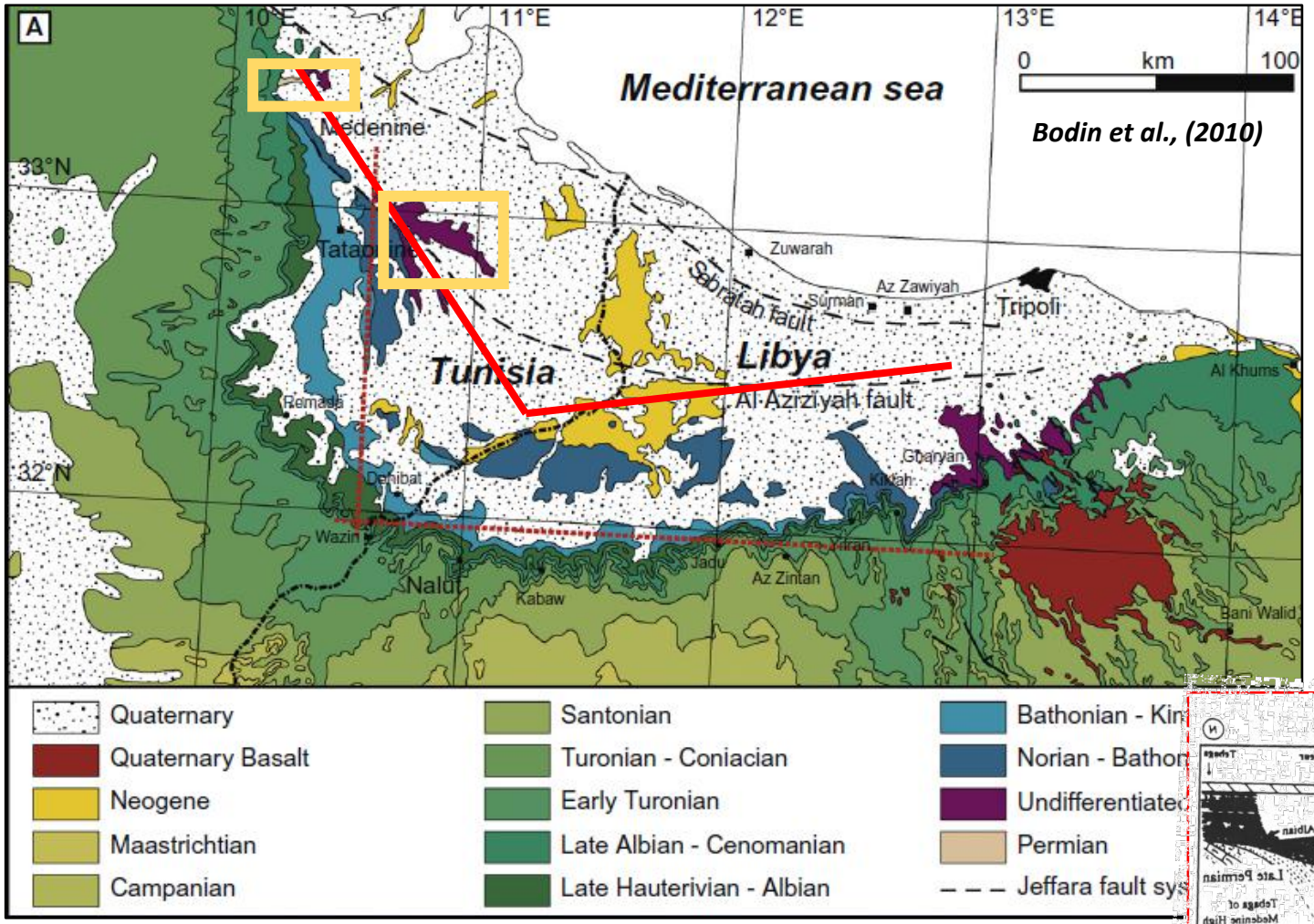
  - To do so, we have to define **where and at which scale** these questions can be answered

    - Quantify and qualify the effect the Hercynian Orogeny has on the architecture and property of the main reservoirs present in the SCB – Based on seismic data and on outcrops

    - Quantify and qualify the effect of fractures in Ordovician and Triassic reservoirs – Based on FMI logs and on outcrops

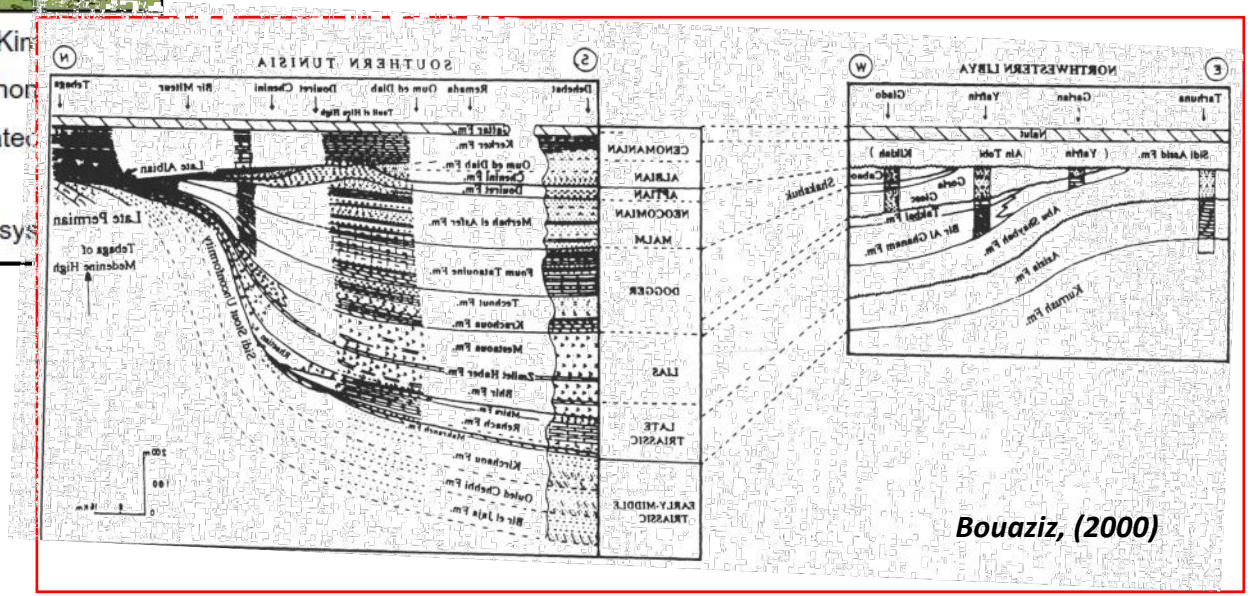
  - Apply **classical and innovative methods** to solve our problems

Outcrops = opportunity – deciphering the impact of the Hercynian Orogeny on SCB reservoirs



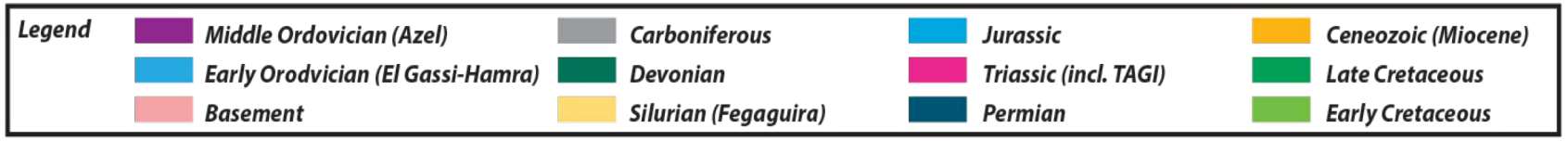
Relief feeding Triassic river systems resulted from the HO. Also the HO controlled the architecture and properties of Paleozoic reservoirs

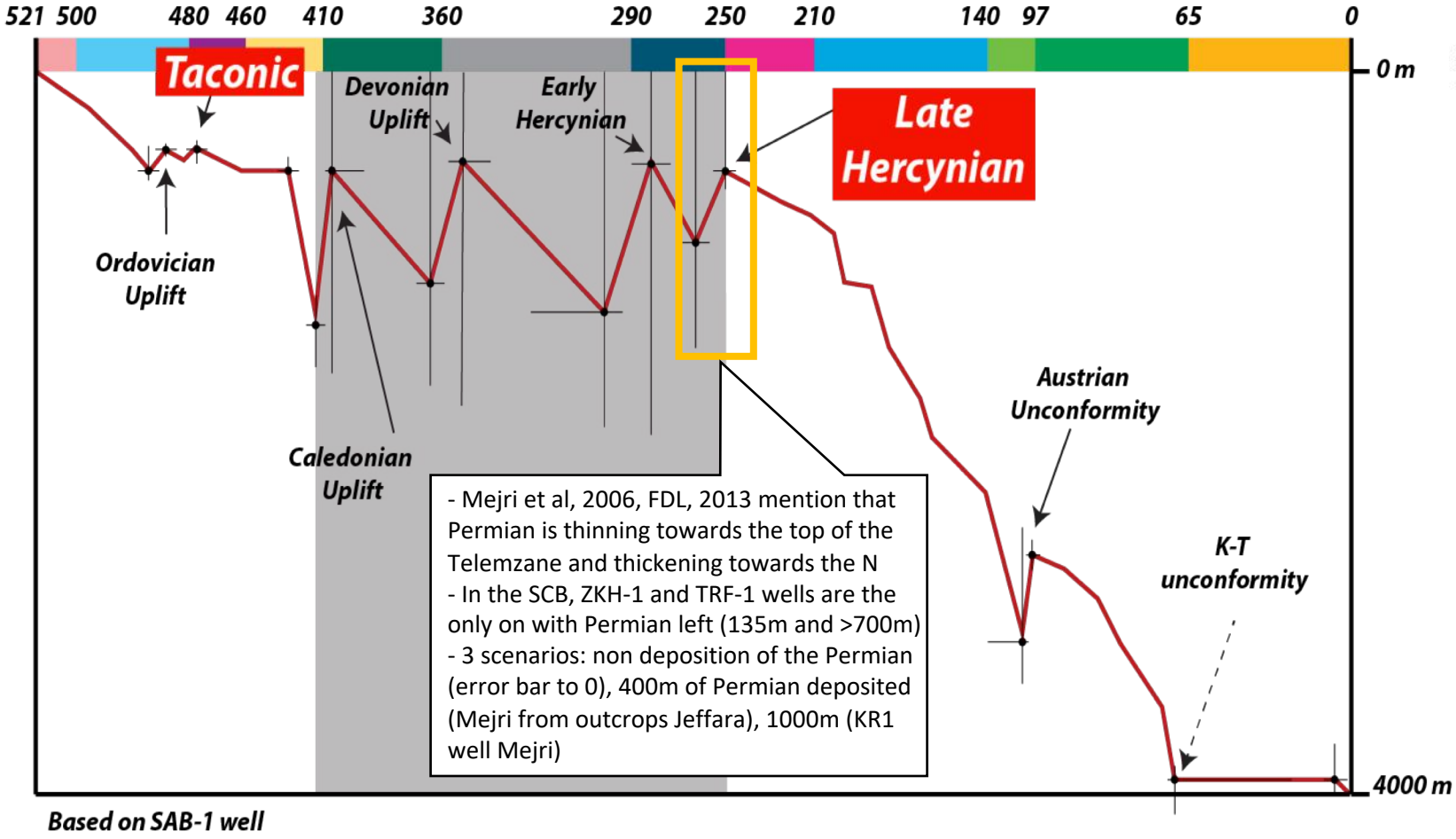
- Where: The Jeffara escarpment provide a surface lab to study the effect of Hercynian Orogeny on the Permian and the Triassic
- Scale: investigation of the origin of the horse toe shape of the Jeffara plain (variation of thickness, effect of fold-faults)



- Method: Fieldwork is planned in December in the Permian and in the Triassic (Structural cross sections, sedimentological type section, etc.)

Structural history of SCB – incomplete or assumed structural models may lead to a wrong petroleum system history reconstruction

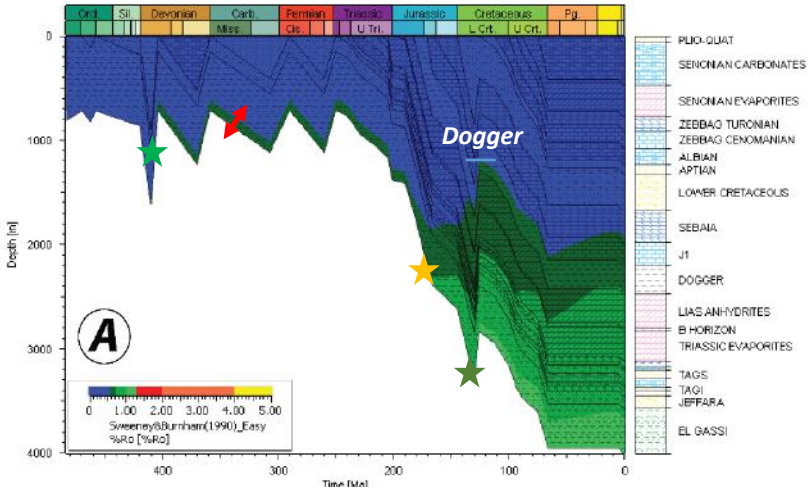




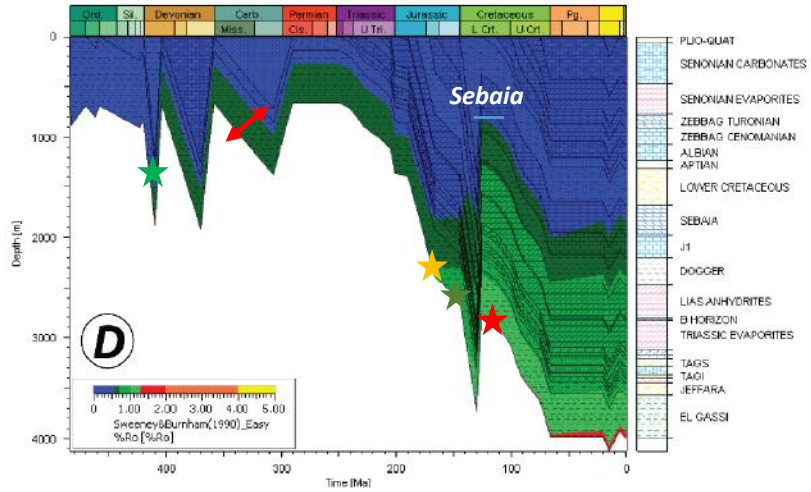
Based on SAB-1 well

SAB-1 Sweeney and Burnham, 1990 - Easy R_o%

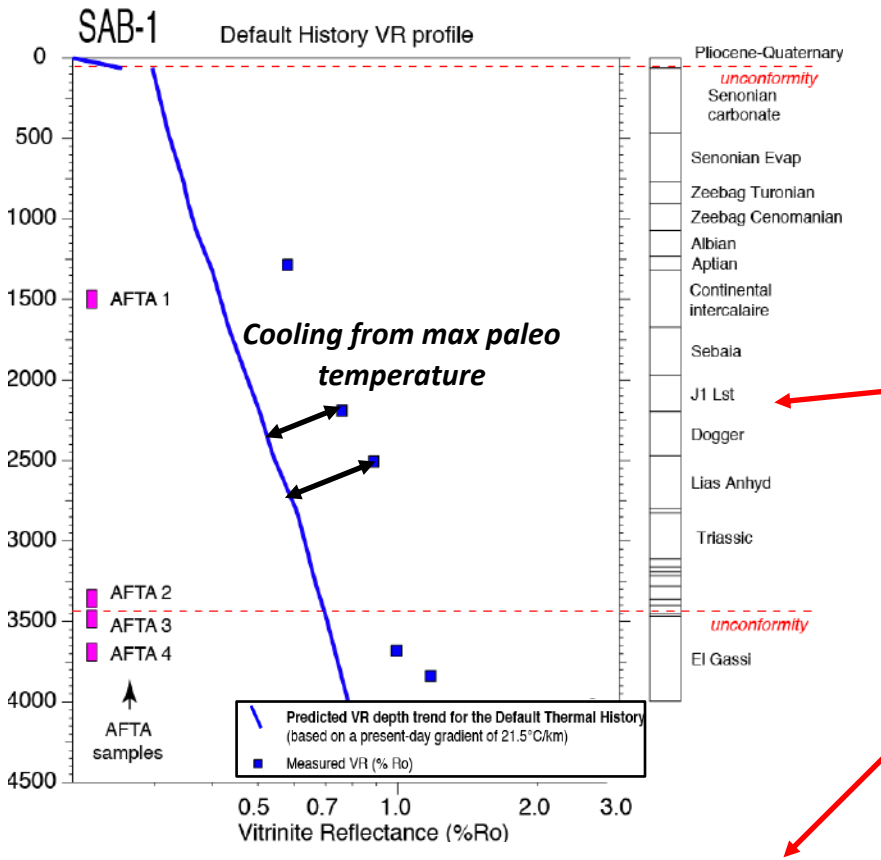
Low-case with Permian

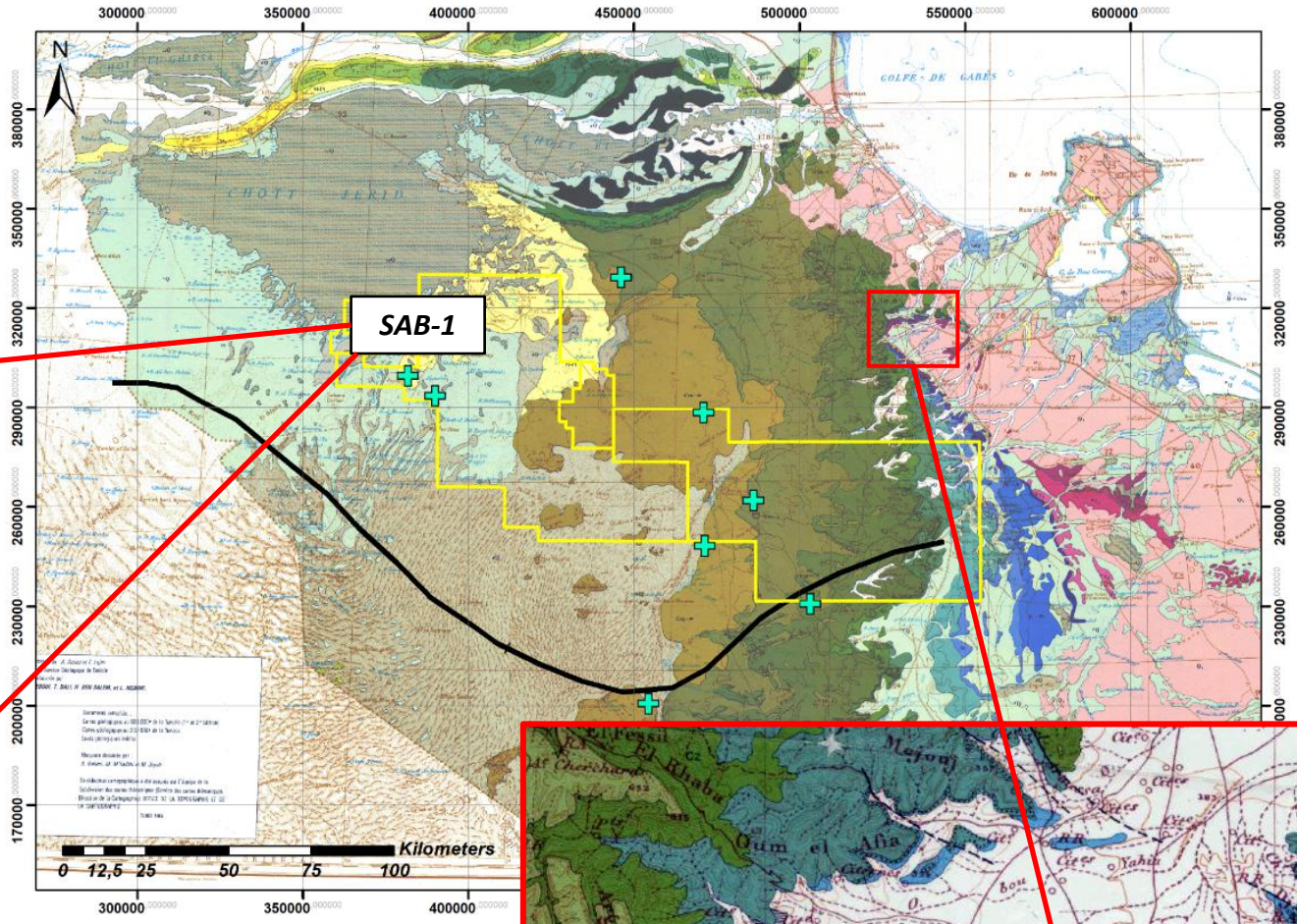


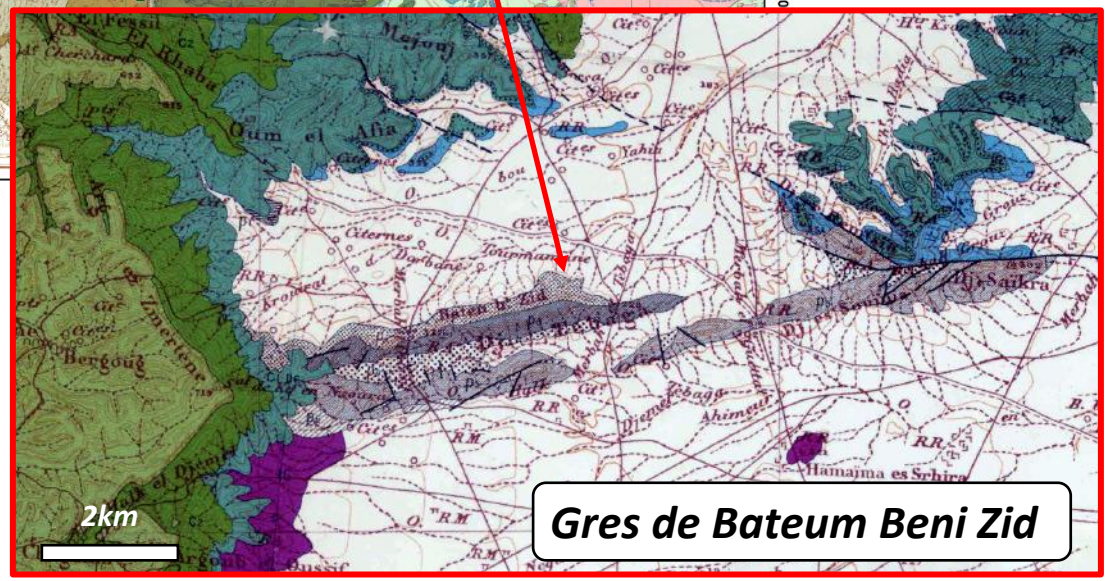
High-case without Permian

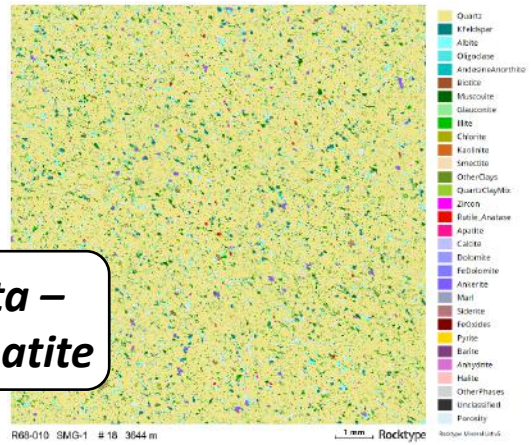


A way of improvement of this model – AFTA data on wells and outcrops



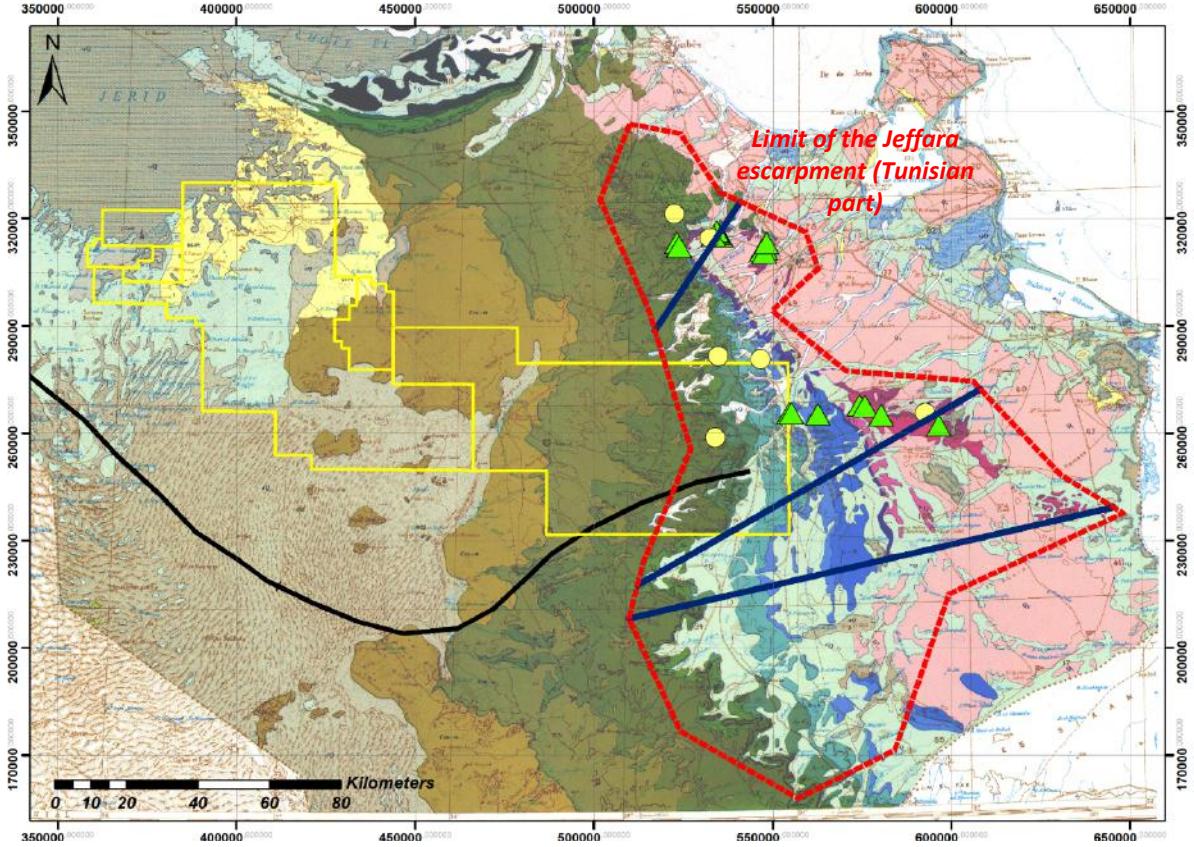




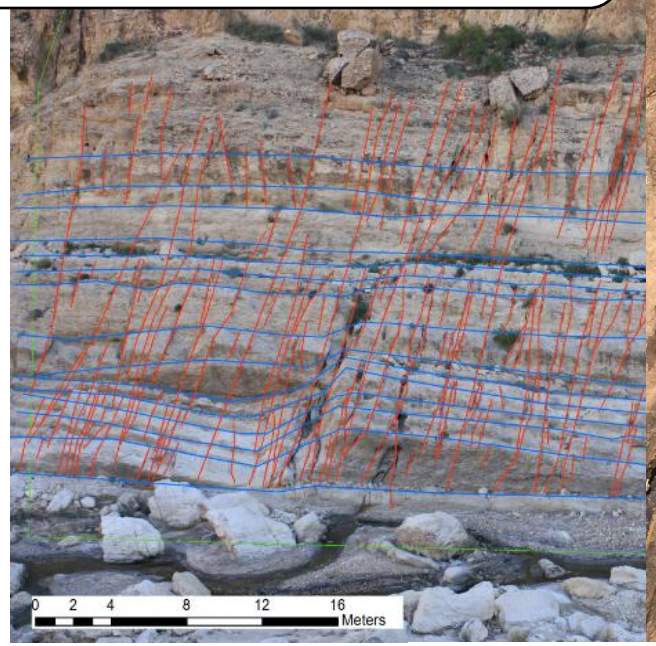


Chemscan data – quantitative apatite

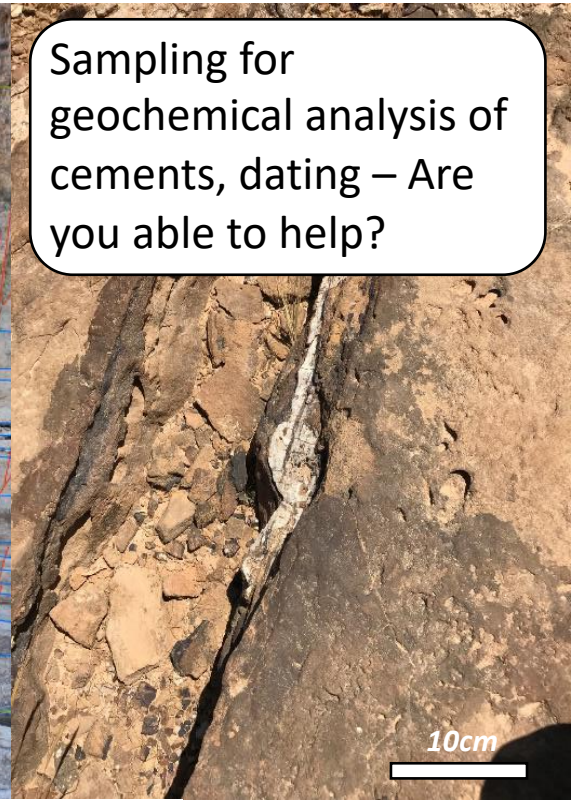
Relate large scale deformation with fracture – TU Delft workflow



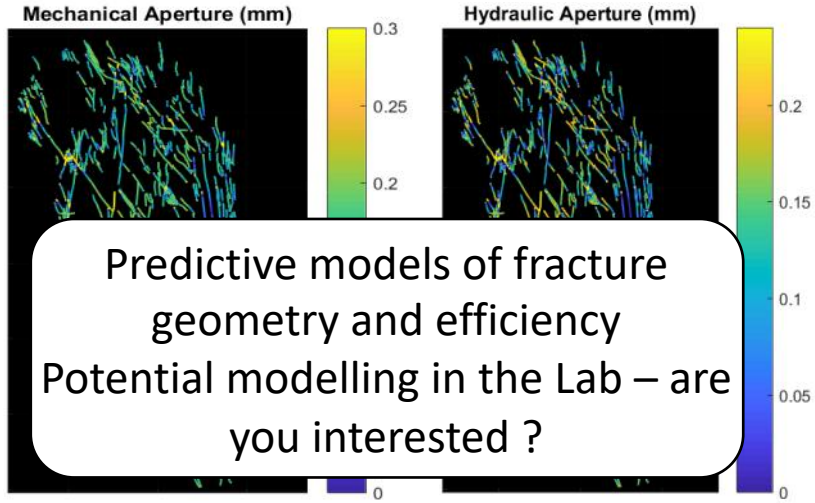
Ground Based approach
Getting statistics on key fracture parameters



Sampling for geochemical analysis of cements, dating – Are you able to help?



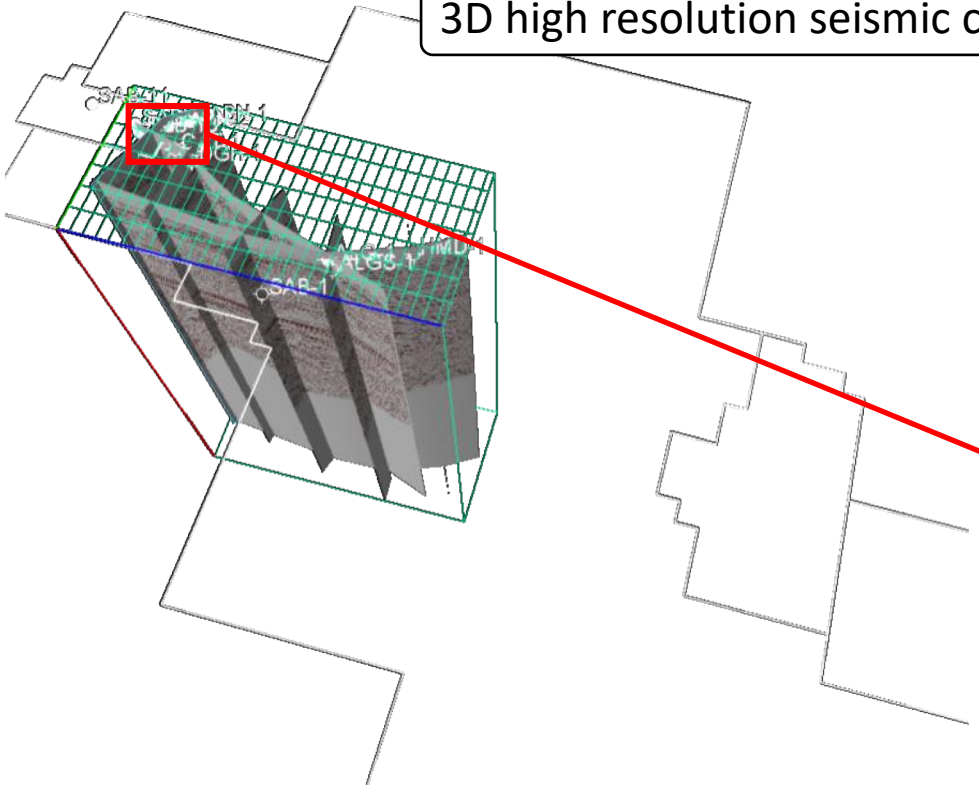
Drone imagery
Analysis of the variability of the network in various fold compartments



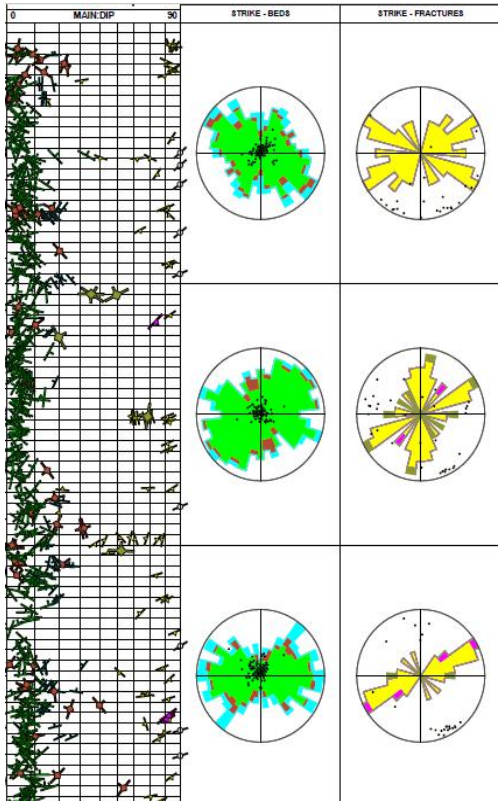
Predictive models of fracture geometry and efficiency
Potential modelling in the Lab – are you interested ?

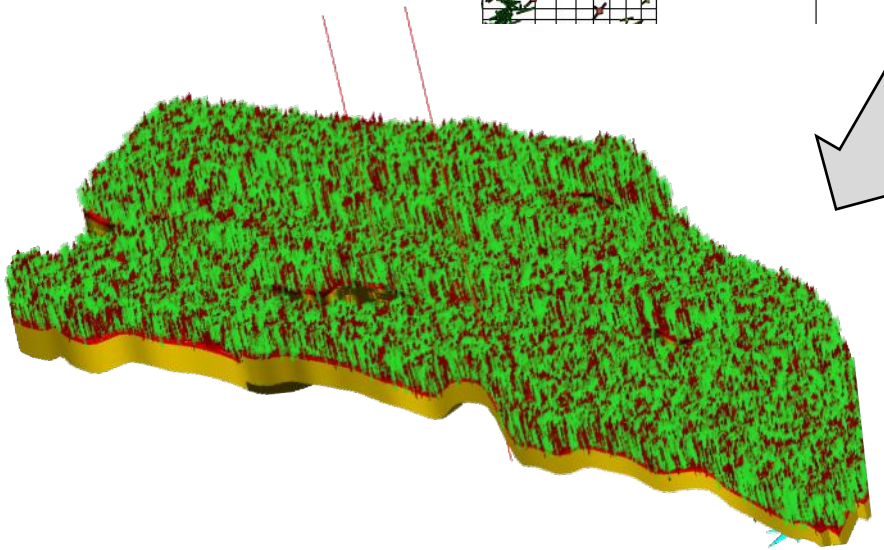
Predicting fractures in the subsurface

3D high resolution seismic cube



Structural model (gOcad) and FMI





- Room and material exist to probably compare the outcrop with the subsurface and to make fracture model at depth
- Iterative process starting with low constraint DFN models (purely stochastic) to advanced (geologic-stochastic) models

Conclusions

- Work has been done on the structural geology of the Southern Chotts Basin. Data available have been synthesized and we have now an overview of the research axis we may follow during this NARG Project (2019-2022)

- Some of the results of the study conducted in collaboration between Mazarine and TU Delft will be presented at the PESGB (poster - October), CAJG (Sousse, talk - November) and through a paper synthesizing our work

- We plan to go out in the field in late November to mid December (sampling and characterisation of the Permian and of the Triassic AFTA, cross sections, fracture analyses) – AFTA data on wells will start before the end of 2019.

- I am very pleased to be part of this group and I hope we will have good collaboration and exciting science ☺

Thank you for your attention!