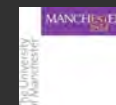


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Academic / Industry Collaboration

“North Africa Research Group - showcasing
20 years of academic research that
delivers for industry



Welcome New Sponsors



Sponsors



Collaboration



AINAFT,
NOC Libya, ETAP



People



Researchers

Manchester

- Prof Jonathan Redfern
- Dr Luc Bulot
- Dr Jason Jeremiah
- Prof Mads Huuse
- Prof Kevin Taylor
- Dr Stefan Schroeder
- Dr Cathy Hollis
- Dr David Hodgetts
- Dr Rhodri Jerrett
- Dr Ian Kane

TuDelft

- Prof Giovanni Bertotti
- Prof Allard Martinus

PostDoc

- Dr Remi Charton
- Dr Pierre-Olivier Bruna

Research Assistants (GIS)

- Ginny Marie Bradley
- Calum Knowles
- Timothy Ohiara

PhDs:

- Nawwar Al Sinawi
- Emmanuel Roquette
- Max Casson
- James Lovell-Kennedy
- Orrin Bryers

PostDoc

- Aude Duval-Arnould

MPhil

- Ian Mounteney
- Tess Oude Essink (TuDelft)

2 - 4 new PhDs to start in 2019

15 Academic Staff

3 PostDocs

15+ Collaborators

6+ PhD / MPhils

Research Assistants



Dr Pierre-Olivier Bruna



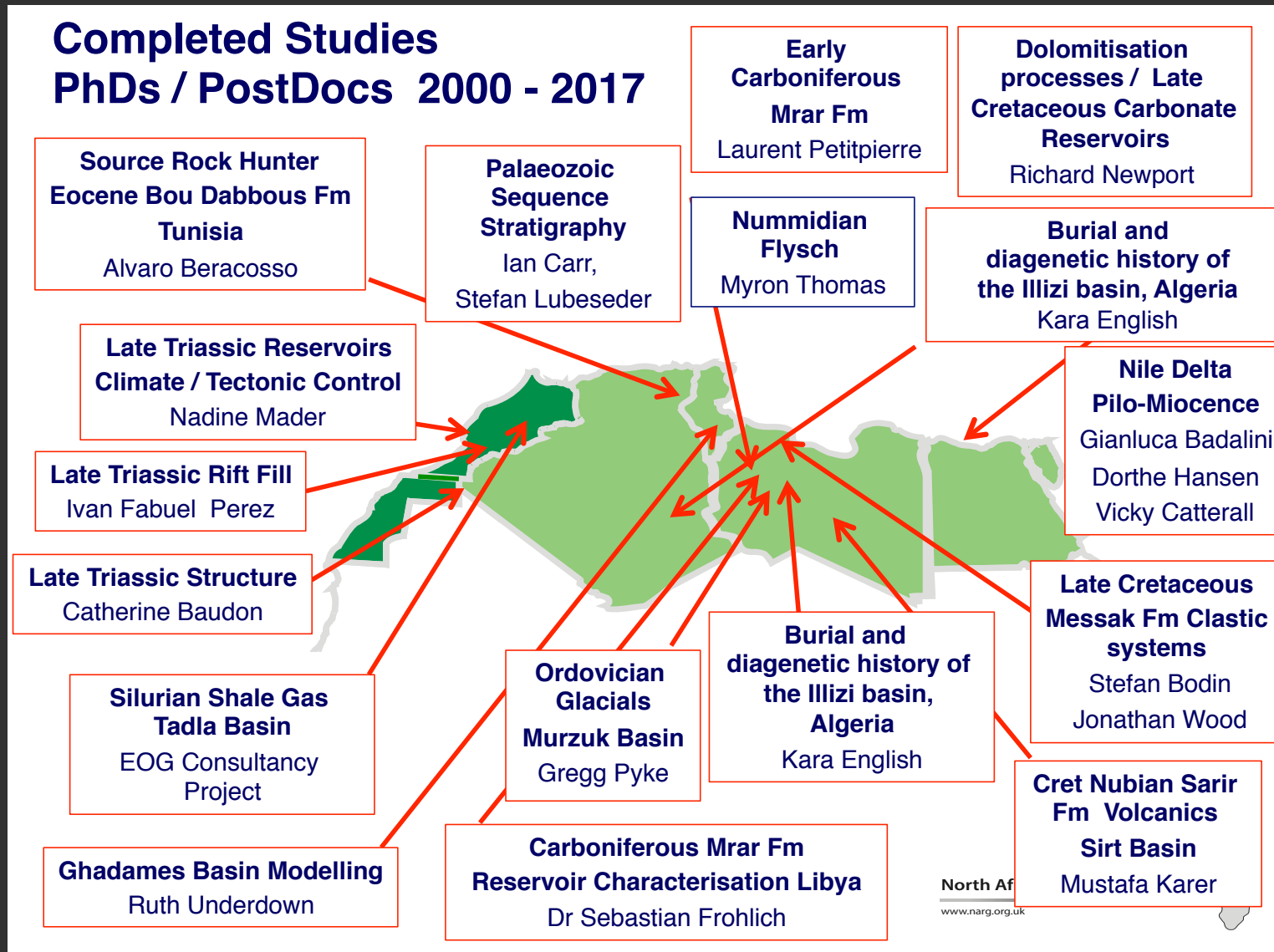
He is a structural geologist, who obtained his PhD in geology in 2013 in Aix-Marseille University (France). In late 2013, he was recruited by the Northern Territory Geological Survey (Australia) to investigate the hydrocarbon potential of the greater McArthur Basin. In 2016, he joined the CEG group of TU Delft, to develop new methods of prediction of the geometry and of the properties of subsurface fracture networks in various tectonic contexts.



Data and Ideas

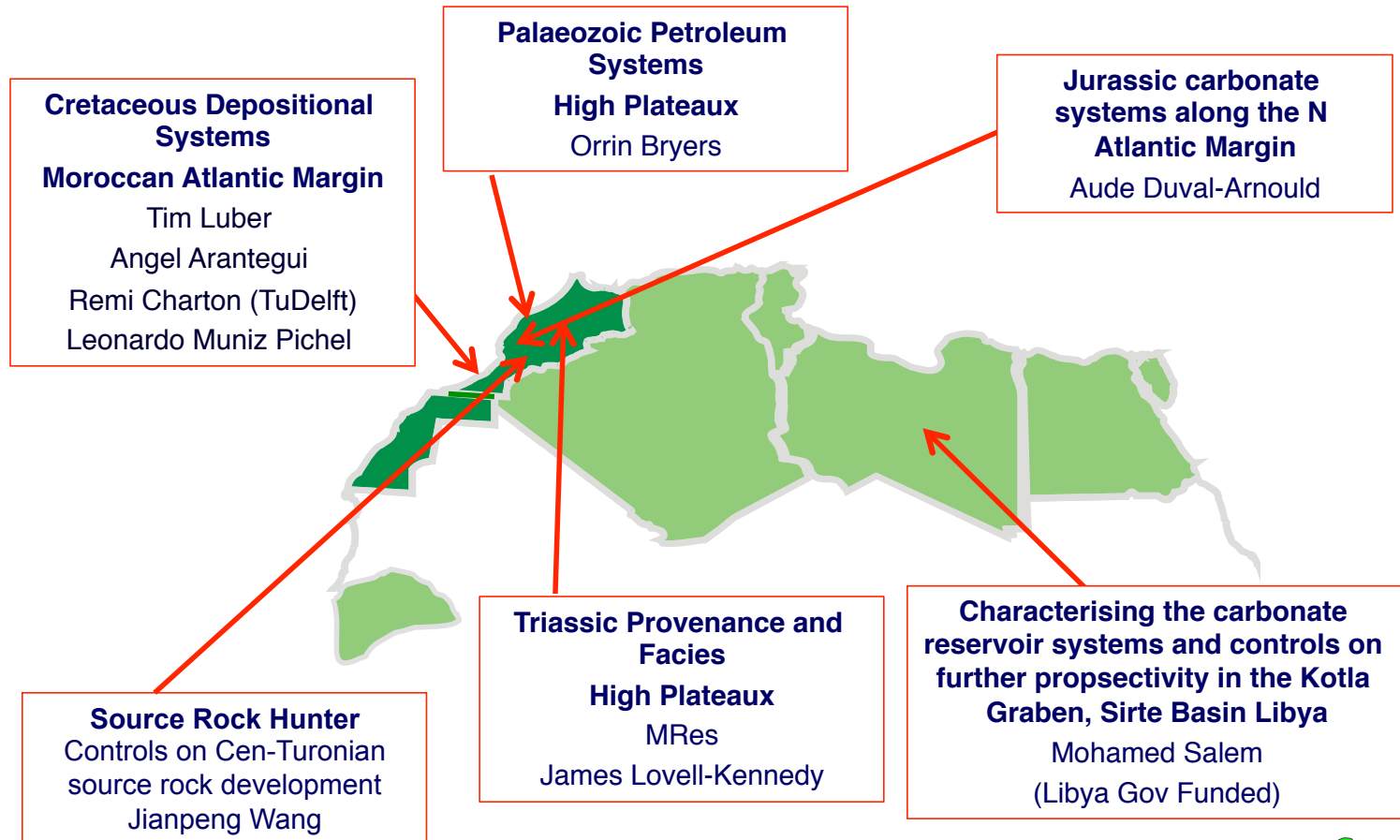


Completed Studies



Recently Completed Studies

Completed Studies 2017 - 18



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Ongoing Studies

Ongoing Studies

Cretaceous Depositional Systems Moroccan Atlantic Margin

Provenance Analysis
Emmanuel Roquette
Valanginian to Berriasian
Strat and Sedimentology
Orrin Bryers

Jurassic carbonate systems along the N Atlantic Margin

Nawwar Al Sinawi

MSGBC FT Exhumation Study

*Giovanni Bertotti,
Remi Charton and
Mohammed
Gouiza*

Triassic Provenance and Facies High Plateaux

James Lovell-Kennedy

MSGBC
Tectonic, Sedimentology
Stratigraphic Studies
Max Casson
Cretaceous Clastic Provenance
Ian Mouteney (MPhil)

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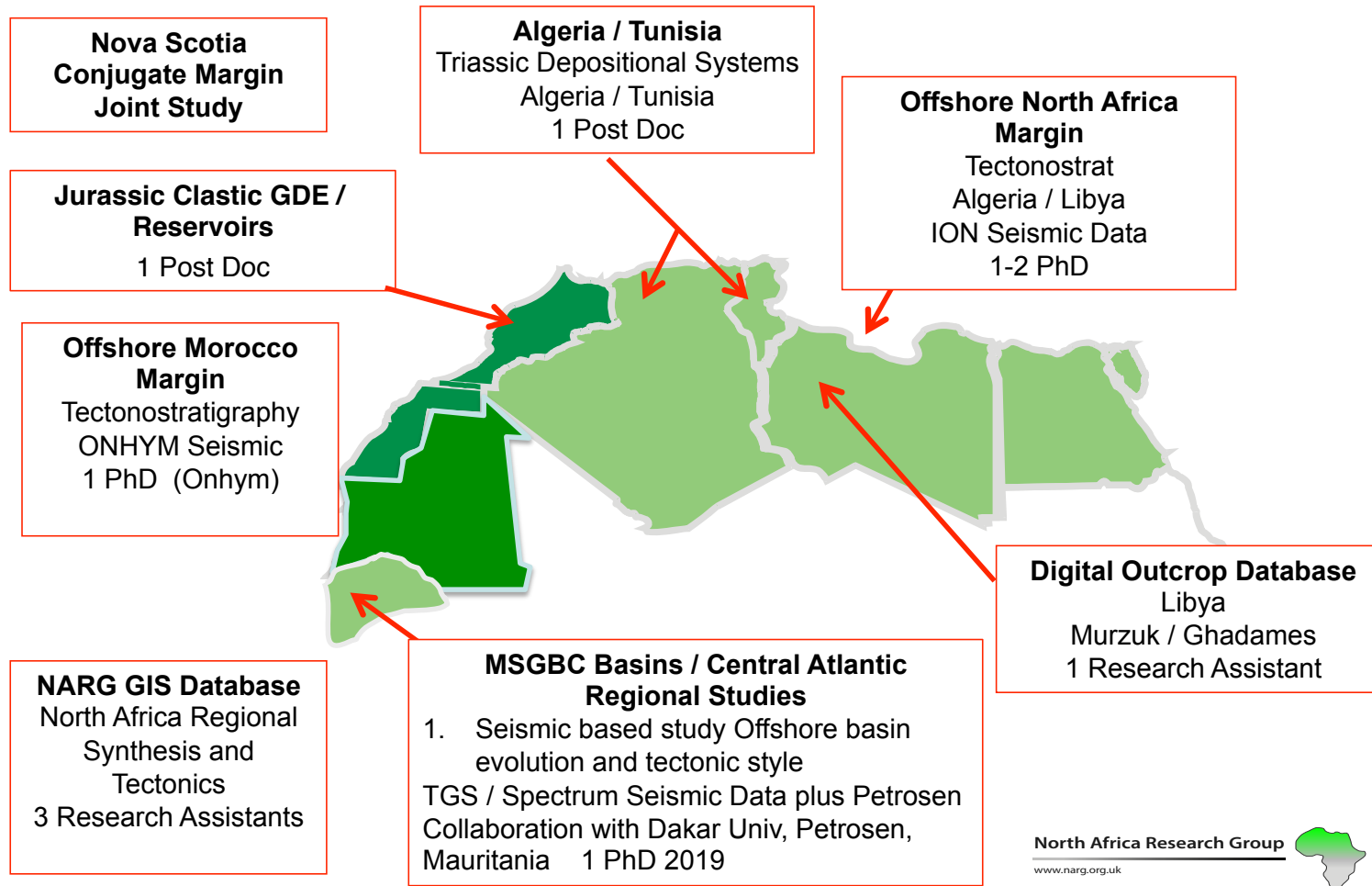
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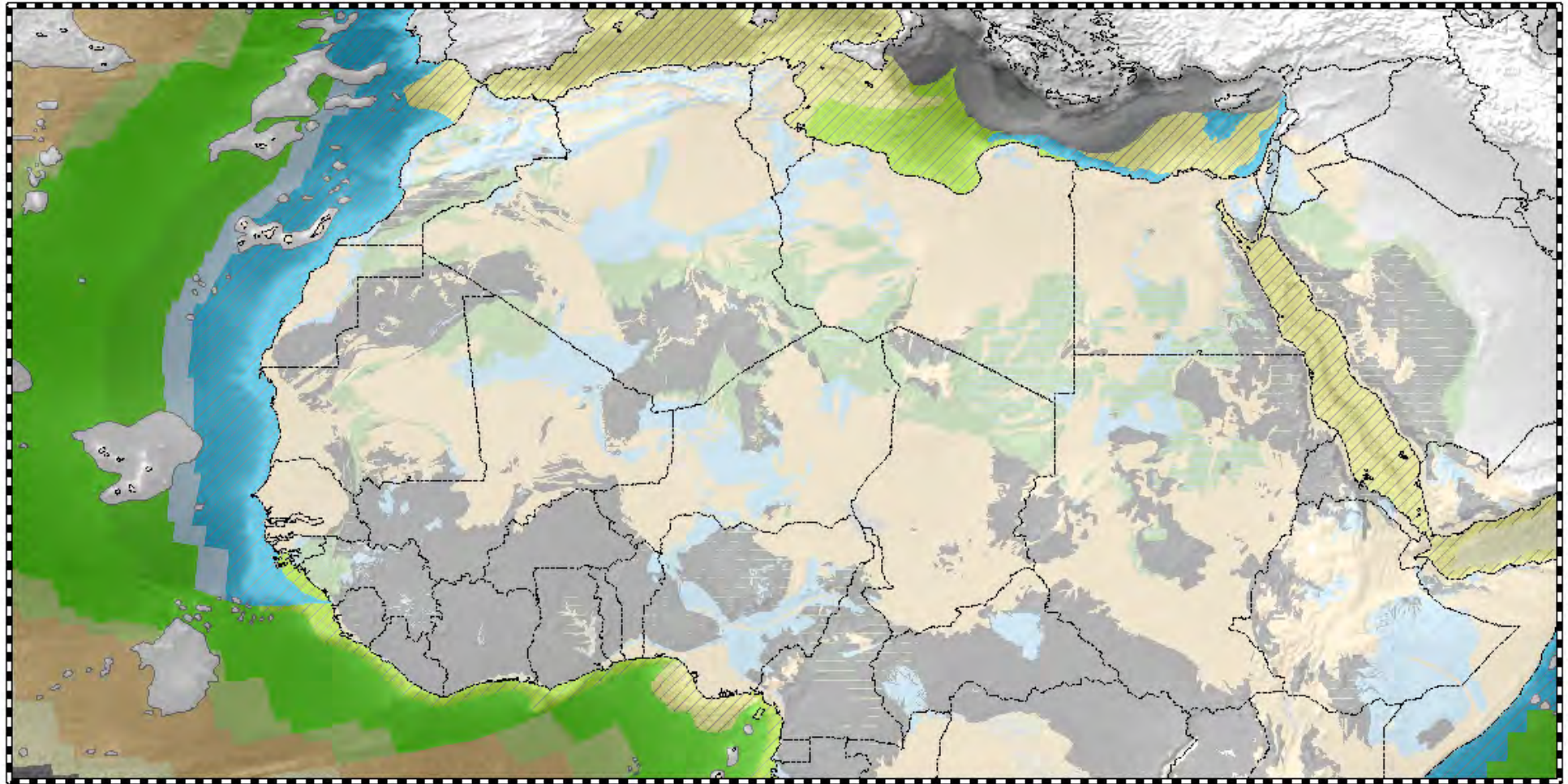


Future Studies


Planned Future Studies



| ARCGIS Database



| Featured data

 > 50 layers



■ Industry Layers

- Wells
- Seismic data
- Interpreted lines

• NARG results

- Outcrops
- Samples
- Photos
- Measured sections
- Cross-sections
- Stratigraphy
- Low-temperature thermochronology
- Time-temperature modelling
- Geochronology
- Paleocurrents
- Palaeontology
- Subsidence
- Salt Tectonics
- Diagenesis

■ Base Layers

- Geography (roads, rivers, cities...)
- Structural features
- Onshore geology (superficial)
- Offshore geology (oceanic crust)
- DEM
- Free-Air Anomaly
- Magnetic Anomaly
- Geological map Africa (Unesco, 1990)

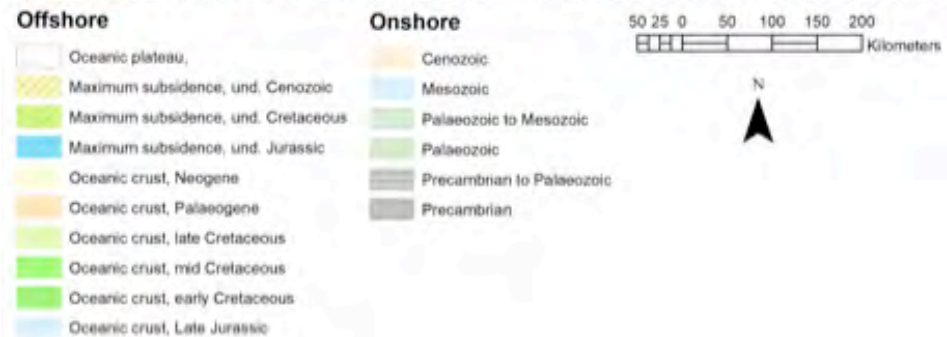
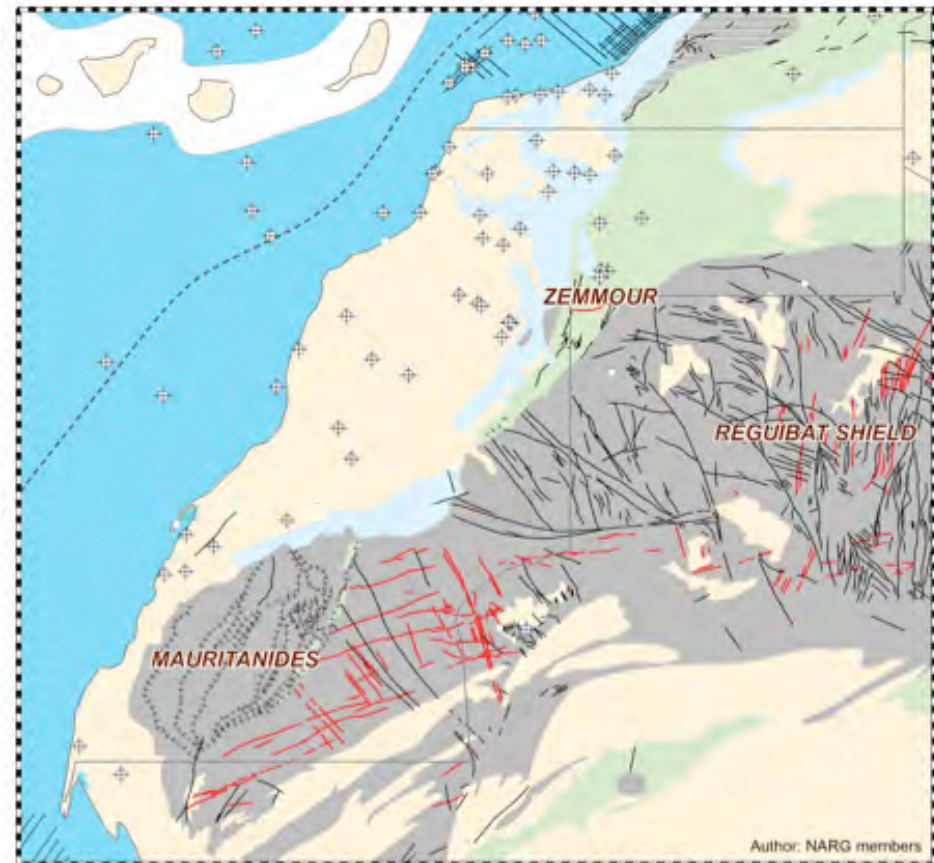
■ Georeferenced maps

- Paleoreconstructions
- GDE Maps
- Location and geological maps
- Results maps

✓ All elements populated with **metadata**, **figures**, and/or **hyperlink** to NARG data

| Web accessible Database

Location figure | e.g. Western Sahara



Knowledge Exchange Fieldtrips / Workshops



Morocco Field Workshops

- Annual workshops
- Attended by Kosmos, Chevron, ConocoPhillips, Repsol, Woodside, Statoil (Equinor), Cairn, Sound Energy, Genel
- Atlantic Margin Petroleum Systems
- Palaeozoic Basins Petroleum Systems

2018 NARG Morocco Workshop and Field Course



In May 2018 we organized another successful 1-day workshop in Marrakech followed by a 5-day field course for sponsors of NARG and invited guests. Attendees included representatives from Statoil (Equinor), Repsol, Woodside, Sound Energy and ONHYM.

This was an opportunity to exchange knowledge and showcase the new research being undertaken on the sections. As usual there were a lot of lively debates and exchange of ideas. It was also a chance to experience the wonderful culture of Morocco.



Group photo




Introducing the Early Cretaceous story at the Tamri section



Dr Luc Bulot (ably supported here by Remi Charlon and Aude Duval-Arnauld) holds court and explains the Aptian ammonite biostratigraphy at the baking hot type section in Tiskatine.



Knowledge Exchange and Impact



The CT source rock interval section along the coast near to Azazaoul

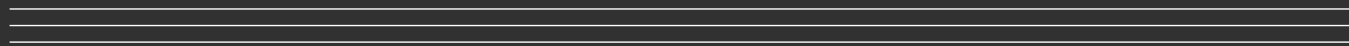


(right) In the distance the outcropping Jurassic Oxfordian reefs at Assif el Hade, part of Aude and Nawwar's field area.



On the coast examining Jurassic corals near Cap Rhir





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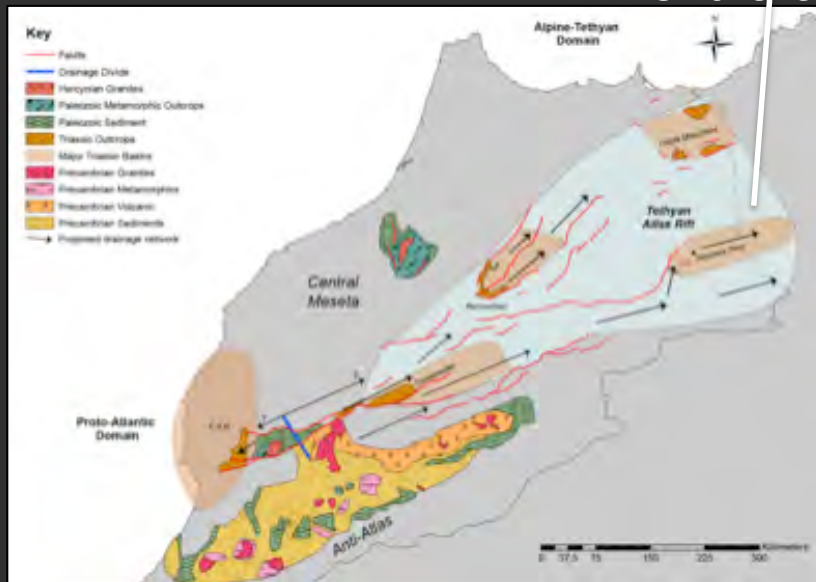


10th – 17th Nov 2019

Triassic Fluvial Depositional Systems and Provenance



Tendrara



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Eastern Morocco Palaeozoic Petroleum Systems Field course

10th to 17th Nov
2019

Summary: 7-day field workshop examining the Palaeozoic and Triassic depositional sequence exposed in Eastern Morocco. From basement, Ordovician glaciogenic facies, Silurian carbonates and black shales, Devonian mixed carbonate/clastics and the famous mud mounds, culminating with the overlying Triassic red beds in the Kerrouchen Basin.

Aim: Evaluate the tectono-stratigraphic framework, reservoir characterization, source rocks and depositional systems. Analogue to plays to Algeria, Libya and Tunisia and the opening petroleum systems in the High Plateaux., Boudenib Basin, Eastern Morocco

Teaching Methods: 7-day fieldtrip. Integration of outcrop observations with subsurface data, evening presentation to reinforce observations.

Accommodation: Accommodation in quality 3-5 star hotels.

Transport: Modern air-conditioned Mercedes Sprinter 16-seater coaches, with seat belts and experienced local drivers. 4wd local transport where required. Airport transfers.

Safety: The field trip is led by Prof Jonathan Redfern and academic staff /researchers from NARG, who have been undertaking research in Morocco for more than 15 years. Full HSE compliance, with emergency response procedures. All outcrops have been visited and assessed for safety. Hard hats, high-vis vests provided, full medical kits on board coaches. Details of local hospitals provided. Local authorities informed of our planned routes. Daily HSE briefings and reporting.

Who should attend: Suitable for both new hires and experienced geologists /engineers.



Previous Course Attendees :
Repsol, Shell, Burlington, BG, Hess,
Anadarko, Wintershall

Devonian Mud Mounds



MSGBC Workshop 2019



1st NARG MSGBC workshop Petroleum Geology of the NW Africa Rifted Continental Margin

A workshop for Universities, Government Agencies and Industry
15-18th April 2019

Taught Courses: Intended for undergraduates, PhDs and local new hire company graduates
25 places available. Please contact Prof Bertotti to reserve a place. Refreshments provided
Location: UCAD, Dakar. 9-4pm

- | | | | |
|--------------|-------------------------------|---|-------------------------------|
| Day 1 | 15th April: | Tectonics of rifted continental margins | (Prof. Bertotti) |
| Day 2 | 16th April: | Seismic analysis and Petroleum Systems | (Prof. Redfern) |
| | | Biostratigraphy | (Dr Bulot) |
| Day 3 | 17th April: | Geology of the NW Africa continental margin | (Profs. Bertotti and Redfern) |

Research Workshop: MSGBC Petroleum Systems - ongoing and future hydrocarbon geology research
Linking industry, academia and governmental organizations to discuss recent advances, opportunities and challenges
Date: 18th April, 9 – 4pm Presentations invited from companies and academics.
Location: Radisson Hotel, Dakar

Contact: Prof Giovanni Bertotti G.Bertotti@tudelft.nl



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- All companies sign a common sponsors agreement
- Any data provided by a sponsor company is held under strict confidentiality, as outlined in the Sponsor Contract.
- This data will not be shared or seen by other sponsors unless explicit permission is granted.
- The research results and interpretation (IP rights) are provided to all sponsors (interpreted maps etc).
- Original data may only be provided if permissions are received from the donor company. Permission is sought prior to any publication that includes confidential data.



Recent Publications

- Charton, R., Bertotti, G., Arantegui, A. and Bulot, L. (2018) The Sidi Ifni transect across the rifted margin of Morocco (Central Atlantic): Vertical movements constrained by low-temperature thermochronology. *Journal of African Earth Sciences*, 141, p.22-32.
- Lubber, T.L., Bulot, L.G., Redfern, J., Nahim, M., Jeremiah, J., Simmons, M., Bodin, S., Frau, C., Bidgood, M. and Masrour, M. (2019) A revised chronostratigraphic framework for the Aptian of the Essaouira-Agadir Basin, a candidate type section for the NW African Atlantic Margin. *Cretaceous Research*, 93, p.292-317.
- Muniz- Pichel et al., 2019, The influence of base-salt relief, rift topography and regional events on salt tectonics offshore Morocco;, *Marine and Petroleum Geology*, DOI: <https://doi.org/10.1016/j.marpetgeo.2019.02.007>



Agenda



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