



## 1<sup>st</sup> NARG MSGBC Workshop

# Petroleum Geology of the NW Africa Rifted Continental Margin

### Taught Course Programme

The 1<sup>st</sup> NARG workshop on the Petroleum Geology of the NW rifted continental margin was preceded by three days of taught courses for students in Dakar, organised in collaboration with UCAD and the Earth Institute.

The courses were taught by G. Bertotti and J. Redfern to a group of over 30 MSc and PhD students; a very motivated group of participants from Dakar University (UCAD), IST, IGD and Petrosen.



## Industry/ Academia Workshop

On Thursday April 18<sup>th</sup>, the Industry-Academia-Government workshop took place at the Pullman Hotel, with over 30 participants from a range of institutions. The meeting was sponsored by Petrosen, with financial support also from the British Embassy of Dakar, BP and TGS. We had a full day of talks and opportunities for discussions, followed by a reception.

The event was inaugurated with an opening address by Mr Mamadou Faye, the Director General of Petrosen, who stressed the growing exploration and development opportunities in the MSGBC Basin, and noted the collaboration with NARG and importance



of such meetings to drive research forward and build links.

This was followed by an address by the UK Ambassador, H.E. George Hodgson, who noted the close links that had been built and encouraging results delivered. He also joked about the name North Africa Research Group, which maybe doesn't reflect our current activities as we expand down into NW Africa! Something we had noticed before, but we like our name and acronym!

We emphasised our gratitude for the support of all our sponsors and the participants who showed the commitment to make this 1<sup>st</sup> workshop a reality.



The goals of the meeting were to provide an overview of the current research and activities in the MSGBC basin and more importantly, to define lines of research and build collaboration for the coming years.



Universities in Senegal were represented, and Dr Aziz (IST-UCAD) gave an introduction to the Earth Institute; a brief summary of capability and aspirations going forward. Prof Sarr from the UCAD geology department then presented a brief overview of the regional stratigraphy of the basins. Other representatives from educational institutions also attended the meeting.

There were many excellent talks during the day, showing cutting edge research and data. NARG updated the meeting on our current work in Senegal, Mauritania and The Gambia. Prof Jonathan Redfern reviewed NARGs extensive studies and publications on the margin and showed the links of our work in

Morocco and the MSGBC. Prof Giovanni Bertotti looked at the basin subsidence and exhumation story, showing NARGs latest Low T Geochronology data along the margin, including new data from Mauritania and Senegal.

Max Casson focussed on one aspect of his PhD, interpreting 3D Seismic data supplied by TGS in the Gambia, where detailed mapping is allowing a better understanding of the platform margin, development of canyons and unconformities, with impact for the deepwater and shelfal plays.

Finally Ian Mounteney reviewed the status of our Provenence Study, being undertaken jointly with Petrosen, which includes extensive sampling of onshore and offshore wells, and now also sampling of all the modern river systems, which was undertaken with support of the Earth Institute.

We also had some posters on display, including work by Amanda Gray-Cunningham from Heriot Watt University examining the sedimentology of reservoir sands in the SNE Field.

TGS showed examples of their every increasing seismic database, some of which is being offered to NARG for research. The new 3D acquisition / merge holds huge potential to unlock prospectively in the basin. Ben Sayers also showed data TGS had just acquired from their new SEEP study, which has the potential to give significant results to de-risk exploration and understand charge / migration in the basin.

Steve Getz from Fortesa discussed the onshore geology and potential for a Jurassic source, presenting data from the Fortesa acreage that is actively being explored.

Simon Hendry from BP gave us an insight into the offshore plays they are targeting, some key research issues that remain, and outlined the huge ongoing development of the Tortue/Ahmeyim gas complex, with first production expected in 2022.

And finally Karyna Rodriguez from Spectrum gave a tour de force look at seismic across the basin, looking at play and source rock development. Much of their data is key to gain a regional understanding and again we have been lucky in NARG to have been a strong collaboration with Spectrum and have been provided with data to aid our studies.

We shared the vision that our collaboration should focus on *knowledge creation* rather than on the classical separation between research and education of new Petroleum Geoscientists on the other. Defining and developing together the relevant lines of research for the next few years will allow us to provide knowledge which will be needed both in the short term for ongoing developments, but also deliver in the longer term, new ideas to expand the plays and fully develop the MSGBC basin. This is also the time when the Universities in Senegal and Petrosen are looking to strengthen their knowledge in specific fields of expertise, which will be of strategic importance to deliver capacity in the industry.

Fully involving Universities in Senegal and Petrosen in research activities is a way to strengthen knowledge exchange with all the involved organizations. Teaching and education can be linked, with research topics adopting a “problem-solving approach”. This breaks down the traditional separation between classroom learning followed by application. It is more efficient and allows faster acquisition of knowledge and delivery of results. This is particularly important for organisations like Petrosen, which face immediate challenges related to the intense exploration and operational activities. Instead of “interrupting” these activities for staff with long periods of external training, we look to develop a model whereby certain Petrosen technical staff are hosted at Manchester or Delft for focussed training, related to specific projects for a few months, thereby building key skills, followed by further collaborative research based in Dakar. This also allows more

efficient knowledge sharing inside the organizations.

We have already started some of these initiatives, and our ongoing Source to Sink Provenance study is working closely with Petrosen staff, in accessing samples for analysis and subsequent interpretation. Our Low T Geochronology project has linked with the IST in Dakar for field work and hopefully soon we will build on that with further research links



To go further, we all recognise that key is the definition of the main exploration / development and scientific challenges we expect in the coming years. During the workshop, we had excellent discussions on this, with strong participations of all involved parties. **Discussion for new research themes included:**

**Palaeozoic systems:** The question has been raised repeatedly as to the possible existence of onshore plays based on Palaeozoic source rocks (and reservoirs). No well has been drilled that has tested these plays to-date.

- Expansion of low-T geochronology to include modelling well data
- Investigation and multidisciplinary work on the Bove Palaeozoic rocks in the SE of the country
- Potential field modelling to help better define sedimentary bodies (their level of maturity and relation with exhumation)

**Expanding the Low-t geochronology to the subsurface with well data:** very important to expand geographically the present database

(probably limited to 2-3 samples – a pilot study rather than anything else)

**Seeps, Maturation and Migration:** following the exciting presentation given by Ben Sayers of TGS, the question was raised to look at seeps onshore. This could be done relatively easily using available literature and remote sensing tools (in the Netherlands there is quite some experience at ITC – Enschede). These seeps could be indicative of petroleum plays and could be sampled.

**The hydrocarbon potential of the Jurassic carbonate platform:** Very little is known about this system. Related topics are the origin of the escarpment forming the western margin of the platform and the reason behind the platform drowning (consequence or cause of the deposition of the terrigenous deltas?). Development of reservoir facies.

- Detailed analysis of seismic data (attributes etc)
- Comparison with analogues (Morocco and elsewhere)

**Provenance:** Comparison with Morocco (large massifs source areas but to-date poor sand development in the basin) and Senegal (extensive Cretaceous sands on the shelf and in the basin, but very limited understanding of the source or sink areas on-going study..

**Heat flow:** Heat flow values are substantially higher than typically observed in passive margins. What is the reason? How did this evolve through time? Impact on source maturity, charge and phase.

- GDE mapping of potential source facies
- Heat flow modelling of the present-day situation
- Using vitrinite reflectance and other indicators, modelling of heat flow evolution.
- Link with tectonic models, basement and mantle / moho models

### **The effect of the opening of equatorial**

**Atlantic:** How far north do the effects of the shear margin reach?

**Basin-scale evolution:** Develop a kinematic model for the basin-scale evolution (with particular focus on the post-rift).

- Regional seismic mapping
- Regional subsidence analysis

### **Summary**

To conclude, this was our 1<sup>st</sup> workshop in Senegal and we feel our ambitious plans were

fulfilled, both in terms of teaching and the research date. We hope this successful model can be repeated to run again next year. We had tremendous support from all that participated, which led to its success and we feel this was a start of building stronger collaborating, driving knowledge exchange and building capacity in Senegal, in NARG and all our institutions. The University of Manchester and TU Delft are very pleased to have been able to play a small part as a catalyst for this, as we deliver world-class research.

### **Sponsors:**



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