EUROPEAN REGION NEWSLETTER

Unlocking the Future

September 2014, Vol. 9 http://europe.aapg.org/ http://europe.aapg.org/newsletter

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PRESIDENT'S MESSAGE

Dear Reader,

Welcome to the September edition of the European Region's newsletter. The summer months have been a busy time for the AAPG organisation as a whole and the European Region in particular. Since the last newsletter I have also attended the annual AAPG leadership Days which were held this year in Snowbird, Utah and I have recently returned from a very successful International Conference and Exhibition in Istanbul which the Region hosted with our friends from the Middle East Region, the Turkish Association of Petroleum Geologists and the national oil company of Turkey TPAO. The latter event was attended by over 1300 delegates and I took the opportunity to engage and canvass opinion from as many of our members as possible. In this newsletter I would like to report out on some of the key messages from the Leadership Days and the value of not only attending the Istanbul meeting but also actively participating in this kind of event. I will finish on a reminder of one of the practical ways in which the AAPG is actively engaged in nurturing the geoscientists of the future through sponsorship of postgraduate studies which I would encourage you all to pass on to your contacts in higher education.

The Leadership Days which were held in August consisted of a series of meetings and workshops during which the shape and nature of the AAPG of the future were discussed with staff from the headquarters in Tulsa. The days were preceded by a workshop for representatives of our Young Professional and Student organisations during which the value proposition for our younger members was discussed. One of the most rewarding aspects for me of the entire event was the session in which the regional Presidents were invited to discuss the findings of the YP and student groups. It was fascinating to hear that the value propositions of membership are remarkably similar across all sections and demographies of membership and the energy and enthusiasm generated by the YP and student delegates greatly enhanced the whole three days.

The program included presentations by a number of the executive based in Tulsa, led by Executive Director David Curtiss and there was clear alignment between the key messages in those presentations and the aims and goals for the European Region which I have articulated in my previous Newsletter articles. A clear message from Curtiss was that this organisation must continue to listen to its members and act on that information to improve our services and deliver what the membership wants. One example of this has been the reaction to the call from members for some time now for the AAPG to work together with other professional organisations to reduce the number of conferences and events that populate our calendars. This organisation is now working closely with other societies to create agreements which will allow the AAPG to co-host some major events with selected societies and I hope to have some positive news on those discussions very soon. The need to listen and respond to our membership was clear and I encourage you all to pass on your views on any aspect of membership to any member of the Regional Council.

The second event I would like to comment on was our recent International Conference and Exhibition in Turkey. Firstly I must thank the staff of the AAPG London office and all the volunteers from the European Region who contributed hugely to the success of this meeting by working on the Organising and Technical Committees; acting as session chairs during the conference; or who took the time to present papers or posters . This event was a clear indication of the AAPG delivering on its promise to deliver great geoscience to its members with over 450 presentations organised into 68 technical sessions during four days in the fascinating city of Istanbul. Two memorial sessions also served as a mark of respect to the careers of two great geoscientists form Europe, Professors Peter Ziegler and David Roberts, who were also great servants of the AAPG. Reflecting on the experience of being General Chairman of the Organising Committee of a team of AAPG staff and volunteers from a wide range of organisations and countries reminded me of the fantastic opportunities that are afforded to our members who actively engage and support our events. Working in a large extended group of volunteer professionals from different cultures and lifestyles, all working towards the same common goal, is an invaluable life experience available to all of our members. I know these opportunities resonate highly with me when I am asked to explain the benefits of membership to groups of young professional and students. All you have to do is contact an event organiser and volunteer to broaden your horizons, expand your international network and gain experience of new cultures. A benefit of membership that is often overlooked.

Finally, a short reminder of one of the schemes by which the AAPG is nurturing the geoscientists of the future and looking to the future health of the organisation. Now is the time for students and faculty heads to apply for AAPG Grant-in-Aid sponsorships and I encourage you to do so. Since 1995 the AAPG Foundation has awarded US$3.25million to 1776 postgraduate students worldwide. In 2014 there were 373 applications from 43 countries. 91 awards were granted of a total value of US$207,750. Of the successful applicants 43% were PhD students and 57% MSc. students. 27.5% of the awards were granted outside of the USA. More details on this scheme can be found in the Grant-in-Aid article in this edition of the Newsletter and by contacting the Region representative on the Grants-in-Aid committee Tony Grindrod at tonygrindrod@f2s.com.

Safe Travels,

Keith Gerdes
AAPG European Region President

2-D Basin Modeling of the WCSB Across the Montney-Doig System: Implications for Hydrocarbon Migration Pathways and Unconventional Resources Potential

Mathieu Ducros[1], Tristan Euzen[2], Roland Vially[1] and William Sassi[1]

[1]*IFP Energies nouvelles, direction Géosciences, France*

[2]*IFP Technologies (Canada) Inc., Canada*

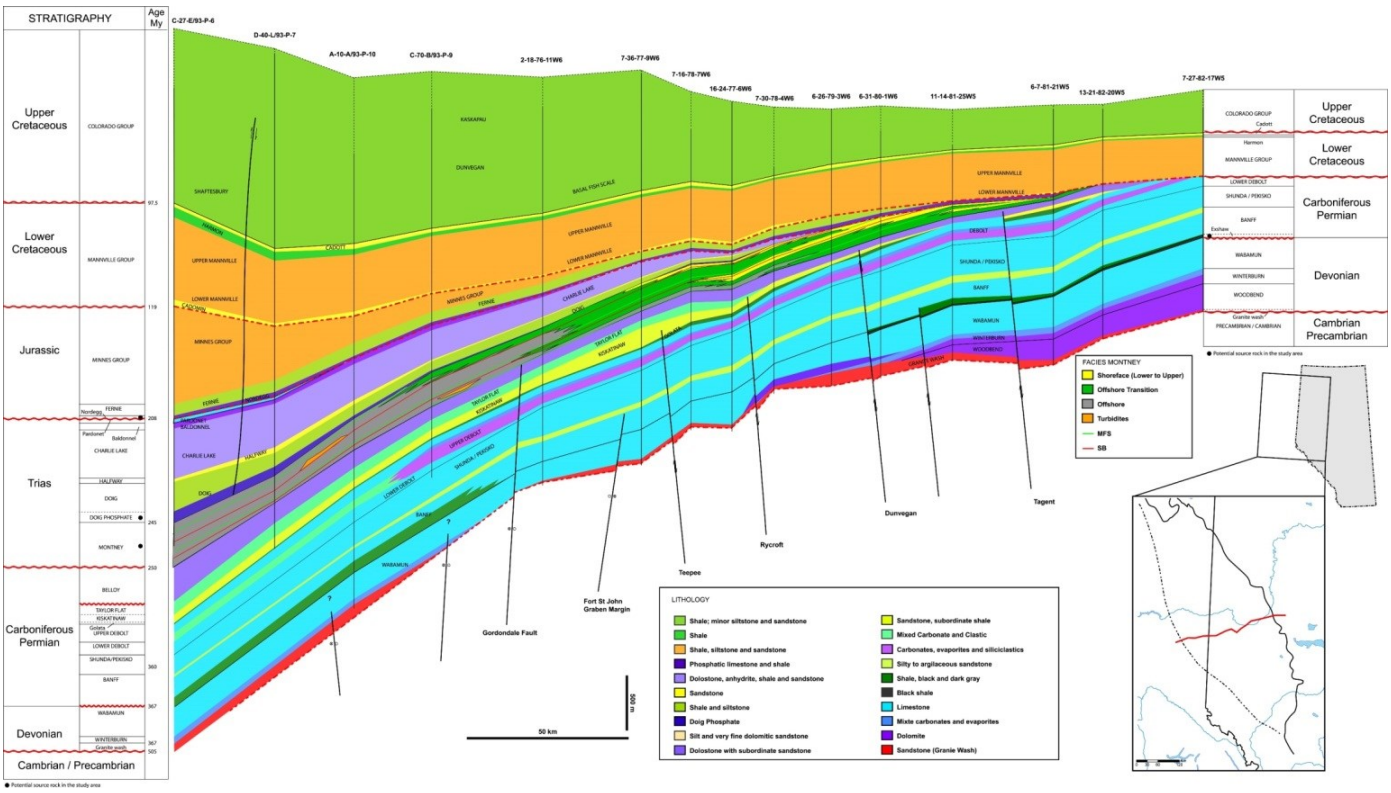

Figure 1: Stratigraphic cross section

INTRODUCTION

For more than ten years, unconventional resources have been of great importance in the petroleum production of many hydrocarbon fields of North America and in Western Canada. The deep part of the Western Canada Sedimentary Basin (WCSB), where conventional reservoirs are already produced, is one of the potentially promising areas for unconventional resources. In this basin, the Montney Formation is currently the most active liquid rich unconventional play. The present study aims at giving a first overview of the complete petroleum system with a special emphasis on the Triassic Montney and Doig formations, through the modeling of a representative section across the WCSB using a basin and petroleum modeling software.

CONSTRUCTION OF THE WCSB BASIN MODEL

The 2-D model of the WCSB consists of 49 stratigraphic intervals that span from the Granite Wash basement that underlies the Devonian Woodbend group to Holocene sediments. Interval boundaries were chosen based on changes in the rock properties from the petroleum system point of view (seal, reservoir rock, source rock…) with the modeling resolution in mind.

Three erosional episodes were taken into account in the model. The second one corresponds to the sub-Mannville unconformity that we assumed to occur from 135Ma to 119Ma. Since this event occurred before the maximum burial depth was reached, limited effects are expected on thermal maturation. The Laramide Orogeny is the critical event that controls the petroleum system. Estimated thickness of eroded sediments associated with the Laramide Orogeny range from 2200m close to the Rocky Mountains to 800m near the Precambrian shield in Saskatchewan. Potential hydrocarbon sources are mainly the Devonian Duvernay Formation, the upper Devonian Exshaw Formation, the Triassic Montney and Doig Formations, the carbonates of the Nordegg Member (Gordondale source rock) and the coals of the Mannville Group (Creaney and Allan, 1990; Higley et al., 2005).

Source rocks can retain hydrocarbon generated in situ thanks to mechanisms occurring during the hydrocarbon generation. Indeed, during organic matter maturation porosity is created in the organic material (Romero-Sarmiento et al., 2013). Moreover mechanisms of gas adsorption also contributes to hydrocarbon retention in source rocks. Thus it is important to estimate hydrocarbon quantity that could be adsorbed in WCSB source rocks.

RESULTS AND DISCUSSION

Simulation results show hydrocarbon accumulations in tight reservoirs of the Montney formation. According to our model, hydrocarbons generated from the organic-rich part of the Montney Formation formed early in the basin history (between -88.5Ma and -57.8Ma) and did not migrate far up-ip in the basin, mostly accumulating in the tight reservoirs closely associated with these source rocks. This is consistent with observations and interpretation proposed by Law (2002) and Ramirez et al.'s (2012) (Figure 2).

Early generated oil from the Gordondale and Doig source rocks could have migrated more to the east in the Baldonnel and Cadomin formations towards the underlying Charlie Lake and Montney formations and filled reservoirs along their subcrop edges. Results (Figure 3) show a very high contribution from the Gordondale source rock in the stratigraphic traps along the Charlie Lake and Montney subcrop edges.

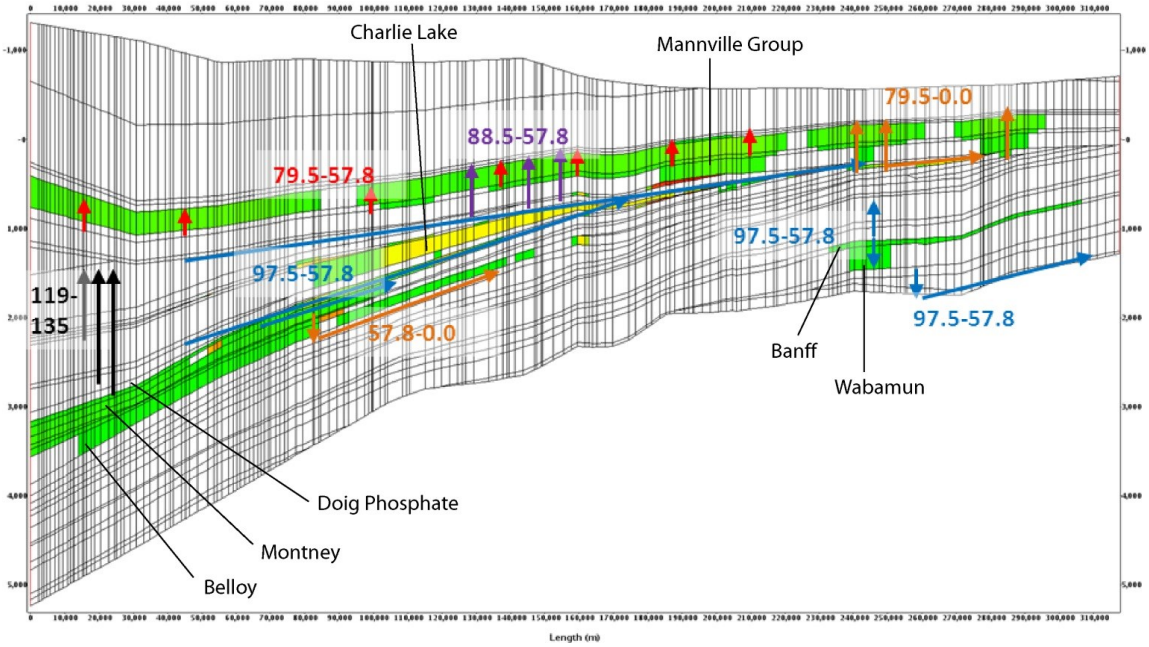

Figure 2: Migration pathways. Arrows represent the direction of hydrocarbon migration with the corresponding ages of migration. Hydrocarbons generated in the Montney formation mostly migrated laterally towards tight reservoirs of the Montney formation or in reservoirs of the underlying Belloy formation. Hydrocarbons generated early in the Gordondale and Doig formations migrated vertically (-135Ma to -119Ma). Then migration was mostly lateral towards the eastern of the basin (-97.5Ma to -57.8Ma). Vertical migration from Cadomin, Triassic reservoirs East of the Doig subcrop to Upper Mannville reservoirs occurs from -79.5Ma to present day.

According to our simulation results, there could be as much expelled hydrocarbons as retained hydrocarbons in the sources rocks including adsorbed gas and free hydrocarbons in organic and matrix porosity). This could consequently represent huge amounts of oil and gas still in the source rocks. Most promising targets for such plays would be associated with Duvernay, Doig and Gordondale source rocks.

CONCLUSIONS

According to our model Montney and Doig source rocks could have started to generate hydrocarbons just before the erosion of the Minnes Group (Upper Jurassic). All source rocks reached their maximum transformation rate just before the last major erosion (early Palaeogene) which corresponds to their maximum burial. This period also corresponds to maximum overpressure in source rocks due to the peak of hydrocarbon generation. Analysis of both available pressure measurements and computed pressures suggest that present day overpressures are entirely due to hydrocarbon accumulation, not to compaction disequilibrium.

Our model was able to reproduce the large diversity of plays that are found in the WCSB: tight reservoirs, shale plays, conventional reservoirs with conventional and biodegraded oils. It strengthens the hypothesis of long-distance (>100km) migration of hydrocarbons from Gordondale and Doig source rocks to Lower Cretaceous Mannville and Triassic Charlie Lake and Montney reservoirs at their subcrop edges, as proposed by Higley et al. contributions to the modelled oil accumulations are consistent with geochemical analysis performed by Adams et al. (2012). In spite of a simplified representation of source rocks distribution and richness, our results accredit the idea that Gordondale and Doig source rocks are major contributors to the main oil accumulations in the WSCB. Hydrocarbons generated by the Exshaw and Duvernay source rocks could have migrated further east in the basin. Hydrocarbons generated in Mannville source rocks have a much more limited distance of migration and have mostly accumulated within the Mannville Group itself. Montney sourced hydrocarbons did not really migrate from their source rock due to very low permeabilities. They can be found mostly in turbidite reservoirs (gas) and fine-grained distal deposits within the Montney formation and in the underlying Belloy formation (mostly gas). According to our results, there is a very high resource potential associated with hydrocarbons retained in the Duvernay, Doig and Gordondale source rocks.

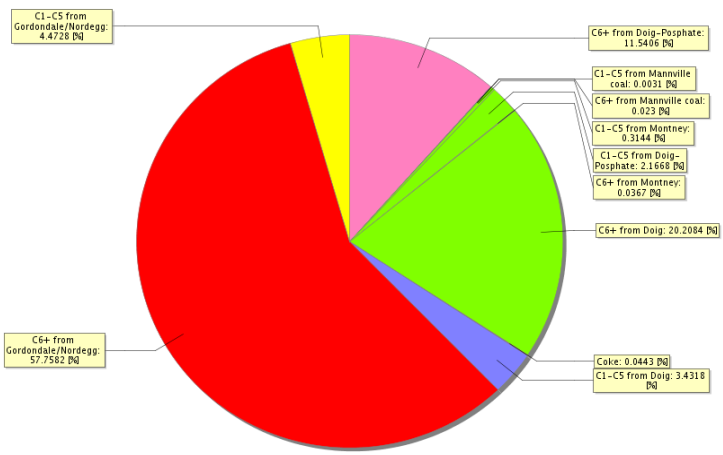

Figure 3: Origin of hydrocarbons of Charlie Lake and Montney formations along their subcrop edge according to the petroleum system model.

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AAPG YP Aberdeen Chapter
St. Cyrus and Stonehaven fieldtrip

August 2014

Written by Samuel McLay

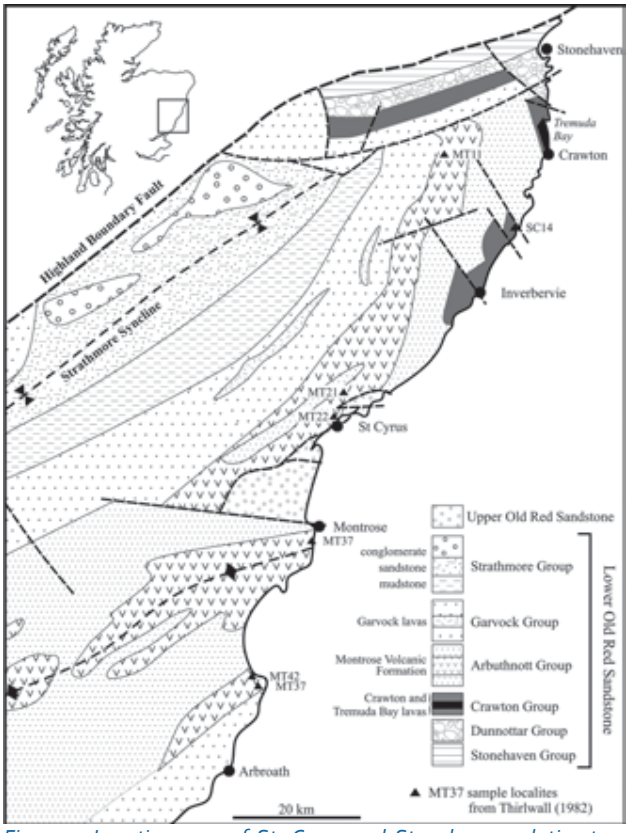


Figure 1. Location map of St. Cyrus and Stonehaven relative to Aberdeen from Hole et al. (2013)

On a Saturday in August the AAPG Young Professionals chapter in Aberdeen went on a day-long fieldtrip along the east coast of Scotland visiting localities in St. Cyrus and Stonehaven (see location map). The aim the fieldtrip was to examine the relationship between fault development, sedimentation and volcanism in the Silurian and Lower Devonian rocks in the Midland Valley basin of northeast Scotland. The strata examined represent analogues for mid to high net-to-gross fluvial reservoirs around the globe and also potentially analogues for hydrocarbon accumulations in the Paleocene succession West of Britain. The trip was led by Professor Adrian Hartley of the University of Aberdeen and funded by Chevron and Maersk.

Exposures at St. Cyrus uniquely expose the lava-sediment interaction that was ongoing at the time of formation of the Midland Valley basin. YPs were asked to examine the different types of sediment present including conglomerates deposited in flash flood events developed between lava flows, rippled fine-grained sandstones developed in short lived lakes as well as the various types of volcanics rocks present. The real crux of the outcrop became evident through the discussion around relative timing of volcanism and sedimentation. Locally present pepperites and the inclusion of sediment rafts within lavas were used to demonstrate the huge influence volcanism had and how it dominates the present-day architecture of the outcrops at this locality.

Stonehaven hosts an excellent exposure of the Highland Boundary fault separating Dalradian metasediements and Silurian sandstones of the Cowie Formation. Despite its historical significance the relative timing of motion of the Highland Boundary fault is still debated and this has huge significance for formation of the Midland Valley basin. Beyond the fault a series of fluvial amalgamated channel-fill deposits were examined and a comparison made to the reservoir models that are currently being built. The outcrop tied-in well with some of the issues being faced by YPs in their daily jobs and Adrian Hartley was able to challenge old age industry assumptions.

The final stop of the day was at Stonehaven harbour where the Lower Devonian facies had transitioned into conglomeratic deposits originally thought to be transported from the Baltic Shield. However, with boulder grain size present in the conglomerates at this location this interpretation was brought into question just as the rain started to pour down. Fortunately with a pub not far away the YPs finished the day discussing what they had seen in the field over a few drinks. Overall the day was a big success for the Aberdeen AAPG YP group and is the second year running after the trip Burghead and Elgin previously. Here's to another instalment next year!

Figure 2. Discussions around lava-sediment interaction at St. Cyrus

Figure 3. YPs examine the Highland Boundary fault at Stonehaven

Figure 4. Group photo of the fieldtrip attendees

AAPG YP Netherlands Fieldtrip

Written by Erik Sens

AAPG\PGK YP President

From 12th to the 14th of September 2014, a group of AAPG and PGK Young Professionals visited Northern Belgium and the far south of the Netherlands for a fieldtrip, and also the opportunity to try out some of the local delicacies. There were almost 20 in the group, with participants from more than 5 different companies.

Saturday morning kicked off with some sedimentary fieldwork in the Saeftinge area, where we discussed the small scale elements of river and delta system formation. After a pleasant morning and some lively discussion, we continued our journey to the "Meester van der Heijdengroeve" area in New Namen. Here we had a guided tour by Peter Maas from Staatsbosbeheer, who showed us a selection of Pliocene sand deposits, covered by aeolian sand from the Pleistocene era. The group spent the evening in Antwerp, exploring one of the most important and historic cities in the Low Countries region.

On Sunday morning we headed out to Kesselberg and were treated to a guided tour by Noël van den Berghe, a Professor from the University of Leuven. Noël used a couple of outcrops to explain the regional geology. This was followed up on Sunday afternoon at our last geological stop: the Kouterhof Hoegaarden where we were guided by Pieter Laga. The Kouterhof Hoegaarden contains some world class specimens of petrified wood, which were fossilized in this area during the Eocene Thermal Maximum (55 Ma).

After the last stop we took the opportunity to finish our mini-fieldtrip with a visit to the Hoegaarden brewery, to try out the well-known Hoegaarden beer.

We would like to take this opportunity to thank the AAPG for their contribution to this fieldtrip!

Figure 1 & 2. Participants reviewing modern delta deposits in Saeftinge to discuss depositional process before visiting outcrops later in the day.

Figure 3 – Reviewing some of the internal architecture of the Pliocene sandstones.

GRANTS IN AID PROGRAMME

Viki Wood

Since 1995 the AAPG Foundation has awarded $3.25 million to over 1700 students from over 50 countries, to assist with MSc or PhD studies. These funds continue to be made available to students and we strongly encourage you to apply, or at least spread the word to others who may be interested. The deadline for the next round of grant applications is Sunday **February 15th 2015**.

How does it work?

Applicants are required to fill in a form describing both themselves and the project they are undertaking. Some supporting information must be presented, such as transcripts, however the majority of the application process can be undertaken online. Distribution of the awards is made through a panel of judges who review up to 20 applicants each on the basis of criteria such as their academic achievements to date, the relevance of the project to AAPG objectives, a statement of support from a faculty advisor, etc.

Some hints for applications?

- Below are some of the common reasons for students failing to obtain these grants. If you are planning to apply then please consider the following:
- Be sure to tailor your application to specific grants (for example if you have a petrophysics projects, perhaps mention the 'Archie grants')
- Be careful not to overestimate your costs
- Communicate the relevance of your project to AAPGs' core objectives
- Follow the rules! There is a lot of detail online about the process and the evidence required; be sure to read it!

In 2013 there were 17 successful candidates in the Europe region, all awarded a contribution towards their studies. To find out more about these grants and the people that benefited from them in previous years, go to the AAPG website or contact Tony Grindrod (tonygrindrod@f2s.com)

EUROPEAN REGION – DL POSITION AVAILABLE

Are you interested in helping out in your region?
Would you like to be involved in the AAPGs' longest running programme?

Since 1941 the AAPG has ran lecture tours, which are open to all. The current lecturers include; Ken Miller, Gary Hampson and Cathy Busby. We are looking for a volunteer to run the European Regions' Distinguished Lecturer programme. You will be responsible for contacting institutes, universities and companies, to find great candidates for speakers to tour around our region. Liaising with the AAPG Europe council through the London office, and AAPG headquarters in Tulsa, you will propose our candidates to the DL committee for selection. Once the selection has been made, the DL coordinator then arranges the programme for hosting the lecturer in Europe. If you think you might be interested, or would just like to find out a bit more, then please use the links and emails below.

For more information on the programme, please follow this link.

Interested? Then please contact Jeremy Richardson (JRichardson@aapg.org) or Keith Gerdes (Keith.Gerdes@shell.com).

AAPG Europe Region Presents

EXPLORE THE CORE

The Mississippian World: Shales and Cyclothems

BGS Core Store, Keyworth, UK

On 5 and 6 November 2014, AAPG presents a unique opportunity to examine a Mississippian sequence first hand — in its broader geologic and economic context. Speakers will be invited to present on topics ranging from pore-scale to basin-scale and beyond, including some key analogues from elsewhere in the world.

The technical workshop entitled *The Mississippian World: Shales and Cyclothems* will look at strata ranging from organic-rich shales, to karstified carbonates and pro-delta fabrics. Speakers from universities and industry will combine to elaborate on this cycle of palaeoenvironments that are gaining renewed significance within the geological history of the UK.

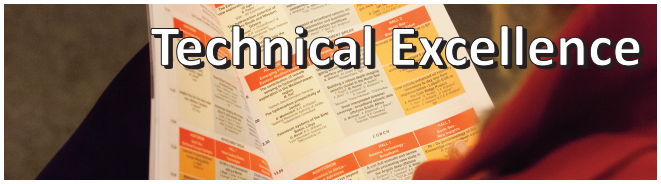
http://europe.aapg.org | europe@aapg.org

PETEX 2014

18 - 20 November 2014, ExCeL, London
Celebrating 25 Years 1989 - 2014

Event Information

PETEX is the largest subsurface-focussed E&P conference and exhibition in the UK, attracting thousands of delegates from across the world and across a spectrum of industry sectors, from supermajors to consultancies. Exhibition space is nearly 95% sold out, featuring the ever popular International Pavilion.



This year PETEX is celebrating 25 years of technical excellence. The conference timetable is now available to view on the PETEX website . We would like to welcome our keynote speakers: Sir Ian Wood, Richard Herbert of BP, Nick Cooper of Ophir, Jon Erik Reinhardsen of PGS and Oonagh Werngren of Oil & Gas UK.

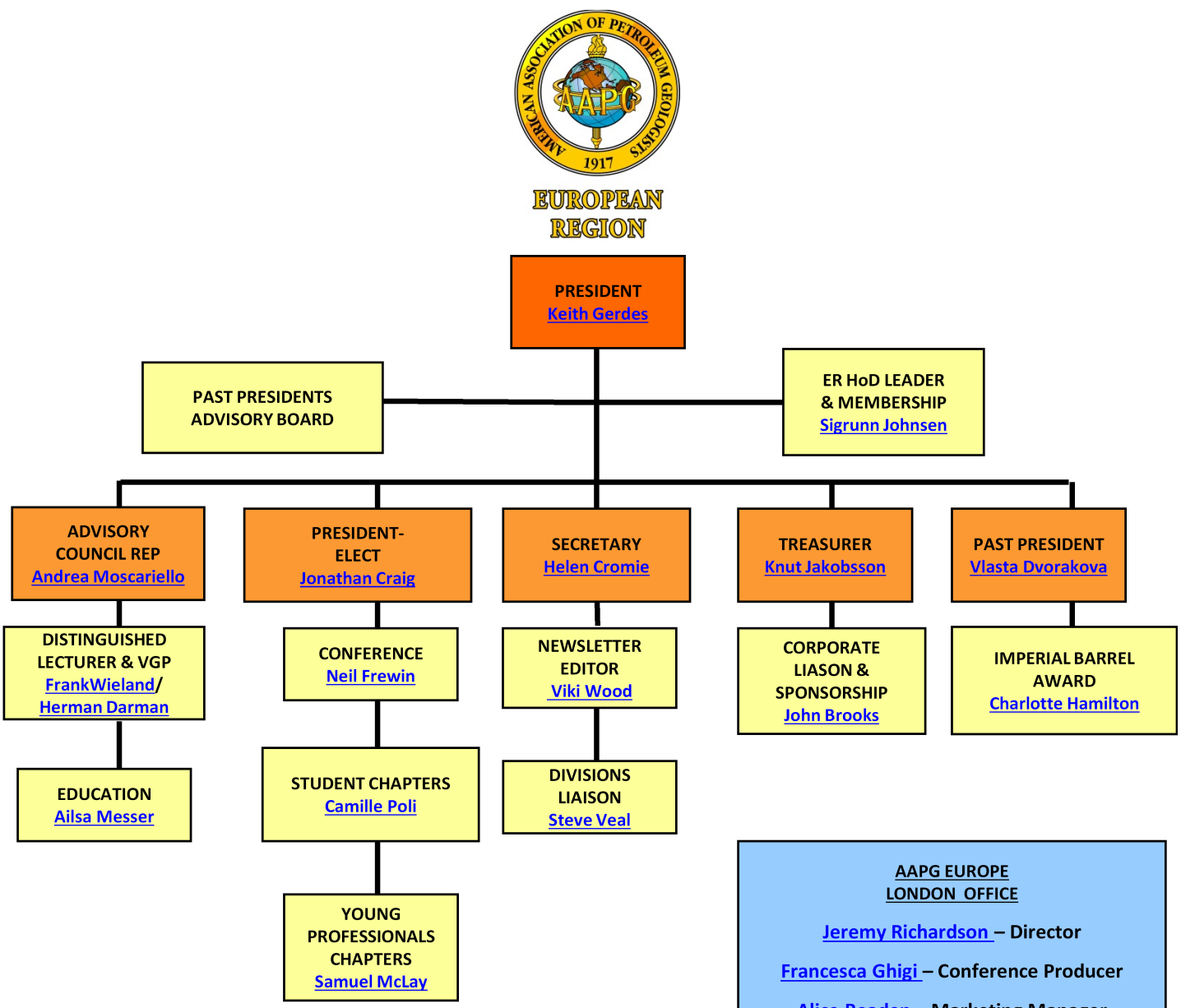
There will also be a special interactive Session, called the PETEX Forum consisting of a panel of experts who will debate on the technical aspects of hydraulic fracturing in the UK.
Following the success from last time, PETEX will again host the Petroleum Geoscience Research Collaboration Showcase, which this year will be moving into a larger area.

PETEX has a rich social programme with an event on every evening - all of which are included in your standard ticket price.
We are particularly pleased to say that the Wednesday night Evening Excursion will be returning in 2014, bigger and better than ever before!

We will again be providing a special area for international representatives, including: Oil Companies; Ministries; Governments and Other Promotional Agencies.
This designated space will provide representatives with a forum to increase their exposure and promote licensing rounds and/or available acerage.

To register, or for more information: www.petex.info

Keep up to date with us on.....



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Energy Institute
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Petroleum Exploration Society of Great Britain
Polish Geological Society
Romanian Association of Petroleum Geologists
Royal Geological and Mining Society of the Netherlands
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