

Aspects of Petroleum Geology on the Isle of Skye: Sediments, Maturity and Complex Reservoirs

23rd to 29th of May, 2010

AAPG Aberdeen-Amsterdam-Lisbon Student Chapters Joint Fieldtrip 2010 sponsors report



Dana Petroleum (E&P)

oilandgascommunity.com



Excursion leaders:

Prof. Adrian Hartley and Dr. Nick Schofield

Organising Committee:

Graham Dauncey, Dr. David Healy, Ben Kilhams, Adam McArthur

Background to Trip

The joint Aberdeen-Amsterdam-Lisbon student chapter trips were the brainchild of Joana Ribeiro (formerly the President of Lisbon student chapter). At the 2009 AAPG European leadership meeting she asked if our chapter would be interested in visiting Portugal that year for a fieldtrip. Representatives from Aberdeen and Amsterdam accepted and this first trip was a huge success. The idea was to provide free accommodation to visiting students in return for organising next year's trip, so this year was Aberdeen's turn! This co-operation between the three chapters has also led to students joining Amsterdam SC's industry trip to Northern Spain and future trips to Holland and Portugal are planned.

A major thank you is due to all our sponsors, without your support this trip could not have happened. In return we included your company logos on:

- All our fieldtrip documents.
- Field trip presentations.
- Additionally your company logos have been highlighted in all our AAPG events at Aberdeen, 6 in total.
- Also at larger meetings, such as the UK leadership meeting in Manchester.
- Promoted company logos at European leadership meeting in Prague.
- Your company was highlighted in a presentation to AAPG President, John Lorenz.
- Logos are highlighted on our website (<http://www.abdn.ac.uk/geology/pg/aapg/aapg.php>).
- Promotional material was circulated where requested.

Fieldtrip activities

Continuing the Aberdeen student chapter's strong links with both Lisbon FCUL and Amsterdam Vrije Universities student chapters, the Aberdeen Chapter was proud to host its first ever field trip, from the 23rd to the 29th of May 2010. Taking six students each from Amsterdam and Lisbon as well as ten students from Aberdeen University to the Isle of Skye, the trip was led by Prof. Adrian Hartley and Dr. Nick Schofield of Aberdeen University. The aim of the trip was to explore the aspects of petroleum geology on Skye, with a focus on sedimentology, maturation and complex reservoirs.

The trip began with a highly entertaining icebreaker event held in Aberdeen's Braided Fig restaurant. All participants on the trip were met by the Rubislaw Pipe Band, led by Dr. Stuart Archer director of the ExploHub at Aberdeen University, who played a variety of traditional Scottish music. Member of the Scottish Parliament for Aberdeen Central Lewis Macdonald was on hand to welcome our visitors to Aberdeen and a Scottish themed buffet was enjoyed by all.



Left: Adam McArthur (Vice President) and Ben Kilhams (President) meet MSP Lewis Macdonald. Right: Amsterdam students meet the Rubislaw Pipe Band.

An early start on Monday morning allowed us a full day travel to Skye, which afforded multiple tourist stops to show our guests the Scottish scenery, including Loch Ness, the Drumnadrochit Loch Ness Monster centre, the spectacular mountain views of the Five Sisters of Kintail and Eilean Donan Castle, before arriving at our base in Portree, Skye.



Left: Eilean Donan Castle. Right: Portree Harbour.

The main purpose of the trip was to develop the students understanding of the petroleum system present in the Mesozoic shallow marine and paralic sediments deposited across actively subsiding tilted fault blocks and also to investigate the implications of the emplacement of Palaeogene volcanic systems. As such the first two days in the field were spent examining some of the best exposed analogues for Middle Jurassic sedimentation in the North Sea. These sediments were deposited in several different basins, which provide a great opportunity to compare and contrast deposits of a similar age but with different depositional environments.

Tuesday was spent examining the Jurassic Inner Hebrides Basin fill exposed on the Strathaird Peninsula. At Camas Malag the unconformity with Palaeozoic Durness Limestone and Lower Jurassic sediments was examined, with a karst surface on the horizontally dipping Limestone overlain by gently dipping marine sediments with abundant Jurassic fossils. The next locality was Drinan to study reservoir quality shallow marine sandstones, firstly the fine grained intensely bioturbated Scalpay sandstone and then the coarse Berreraig sandstone, which exhibits bioturbation and large scale structures. In addition the Raasay Ironstone, an important chamositic ore which extends across the basin was examined. The final stop of the day was to Elgol, here with the Black Cullin mountains behind us we examined spectacular exposures of cross-stratified sandstone in the Berreraig Fm. exhibiting migrating sandwaves up to 2.5m high. Above the sandstone Oil Shale is intruded by a dolerite sill, locally deforming and cooking the normally under mature shale. Finally the Elgol Sandstone deposits were inspected, this unit coarsens up from lower shoreface to prodelta deposits, which display herringbone cross-stratification.



Left: Students examine the unconformity at Camas Malag. Right: Cross stratification of the Berreraig Sandstone at Elgol.

On Wednesday morning we crossed into the Sea of Hebrides Basin, exposed to the north of Skye on the Trotternish Peninsula, to compare different sediments of the same age as the previous day's stratigraphy. The first stop was Berreraig Bay and after a quick descent down the cliff side we were able to compare the sediments with the previous day's outcrops, noting how the Berreraig sandstone here is fine grained and forming large continuous bodies deposited in a more open marine environment, when compared to the restricted deposits of the southern basin. Instead of the Ironstone a thick shale horizon is present where the students spent time hunting ammonites from nodules fallen onto the beach. The next stop was a quick visit to Invertote to examine the equivalent of the Elgol Sandstone in the northern basin, which here forms an incised valley fill overlying an erosive unconformity.



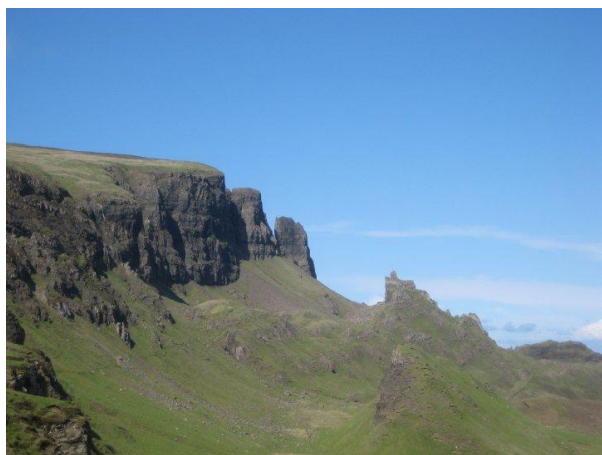
Left: Spectacular scenery at Berreaig Bay, with volcanic sills overlying Middle Jurassic sediments. Right: The Elgol Sandstone at Invertote.

That afternoon we visited Talisker distillery, the only whisky distillery on Skye, where all participants on the trip were treated to a tour of the site and of course a dram of whisky! That evening we had a group meal in the Cafe Arriba at Portree harbour, which served local dishes with a Mediterranean twist, which suited the trip well as every day we enjoyed sunny weather.



Left: Students enjoy the sun outside Talisker distillery. Right: Group meal in the evening.

Our final day in the field was used to examine the complex reservoir analogues on Skye and the maturation, both effects of the Palaeogene volcanic. The morning began with a quick trip to the Staffin Fossil museum, which specialises in dinosaur remains and trace fossils which can be discovered in the Middle Jurassic sediments of Staffin Bay. We then began a tour of the important sill complexes and inter-sill sediment outcrops of northern Skye. We began at Invertote quarry, where a large sill is exposed which highlights the two main varieties of dolerite which form the sills on Skye. From here moved on to examine the Kilt Rock exposures where a large sill complex with columnar jointing overlies Jurassic sediments. At Culnaknock “broken bridges” were examined. Broken bridges occur where multiple sills have been emplaced and form connections between the sediments, disrupting the local stratigraphy with the potential to compartmentalize reservoirs and are very important to the understanding of sub-basalt oilfields. The maturation effects of the sills on Jurassic mudrocks were also examined at this locality, noting how the sills had locally cooked the shale. At Staffin Bay discussion on large scale sill emplacement structures took place and intra-sill Jurassic sandstones and limestone were examined. The effects of sill emplacement on the host rock was also studied, in addition to observation of igneous / sediment interactions with examination of ropey flow and pendant structures within sills at the sediment contact. Finally a visit to the Quirrang, where large slump blocks of basalt are actively sliding on a listric surface developed in the Jurassic shale. This enabled us to examine rotated fault blocks which are used as analogues for North Sea oilfield structures.



Left: A broken bridge at Culnaknock. Right: The Quirrang landslips and rotated fault blocks.

Quotes from trip

Prof. Adrian Hartley: *“I thought it went really well, good to see a bunch of interested motivated students from different countries enjoying the excellent geology and hospitality of Skye.”*

Dr. Nick Schofield: *“I was really pleased with the organisation of this trip, everything went exactly to plan.”*

Amsterdam Student Chapter President Cameron Heins: *“The Amsterdam students very much enjoyed the excursion for several reasons. First and of course most importantly Skye offers a wide range of different types of well-exposed outcrops, it is not only the size but also the text-book quality of the sedimentary outcrops that makes visiting these outcrops even more worth while! What I am talking about is that on the island two separate basins with coastal sequences of high reservoir can be observed and differences between these reservoirs can be discussed. Considering reservoir geology this helps to add dimensions when you're thinking subsurface! Furthermore we were firstly introduced to the concept of broken-bridges (a bridge being a connection of sedimentary rock in between sills) which will be of great influence on the flow characteristics of a reservoir.*

Besides the amazing geology there was the sociological aspect of the excursion; geologists from Lisbon, Amsterdam and Aberdeen got to share thoughts and culture together. Furthermore we would like to mention the great hospitality, friendliness and humor of the British! The excursion was well organized and our students have learned a great deal about the geology of Skye and the life in Scotland!”

Quote from Lisbon student chapter: *“The students of Lisbon University were delighted to come to Scotland and visit the fantastic Isle of Skye. The scenery was absolutely beautiful and we learned so much about the geology of the country and how to examine a basin for its petroleum potential. We must especially thank Aberdeen for helping us with money to send our students.”*

Cost breakdown of trip

Thanks to your generous sponsorship we were able to cover the entire cost of the trip. Your generosity paid for the following:

- Aberdeen youth hostel for visiting students
- Portree youth hostel fieldtrip accommodation for students
- Accommodation for course leaders
- Vehicle hire & fuel
- Icebreaker event
- Fieldtrip group meal
- Talisker distillery tour
- Fieldguide printing
- Aid for Lisbon students travel
- Breakfasts for students in Skye

Also, thanks to your support we were able to fully subsidise the travel to Aberdeen for one student from Lisbon.

Edinburgh Undergraduate Trip

In addition to this highly successful trip, we used remaining funds to support a fieldtrip for Aberdeen University undergraduates to Edinburgh and the Fife Coast. Nine students, most of whom were undergraduates, took part in a weekend excursion to Edinburgh and Fife on the 11-13th June. As well as providing a valuable post-exam social opportunity, some serious geology was involved. An excursion to the famous sections at Salisbury Crags and Arthur's Seat allowed a rare insight into West of Shetland oil fields and exploration, examining large scale sill and lava flow morphologies and their relationship with host sediments. In the afternoon a visit to the Dynamic Earth museum reminded us why we study geology! The return to Aberdeen was punctuated by several stops at Fife coastal localities including high porosity 'reservoir' sands and oil shales at East Wymess and superb fossil collecting opportunities.



Left: Students examine the world famous Hutton's Section. Right: Students examine oil shale in Fife.

Future Student Chapter events

Continuing our links with Amsterdam and Lisbon Universities we have been invited on a fieldtrip in August 2010 to visit the Netherlands and Germany to visit Europe's largest onshore oilfield and examine Triassic reservoir outcrops. Lisbon also hopes to host a fieldtrip next year to southern Portugal.

The student chapter will also continue to organise a wide range of events and guest speakers from the world of petroleum geology and continues to act as a focal point for developing a professionalism and industry contacts for students through meeting industry representatives.

Bucharest/Aberdeen Petroleum Training Course

Next year we shall be hosting a week long training course on petroleum geology for international students who are not privileged to have the access to the first class training facilities available here in Aberdeen. We plan to host four students from Bucharest University, who along with six undergraduate students from Aberdeen shall receive intensive training in petroleum geology. This week long course will take place in May 2011. In return Bucharest University will be offering students from Aberdeen the exciting opportunity of a fieldtrip to the Caspian region to examine the petroleum system of a major hydrocarbon province.

An extensive range of activities for this training course is planned, including intensive training with modern industry software and technology, courses on exploration and production geology and fieldtrips to relate the courses to real geology. Additional activities such as visits to company offices and training centers are part of this course.

As a volunteer student-run non-profit organisation we require sponsorship and for this course to run we are seeking total sponsorship of £5000, similar to that raised for our Skye fieldtrip. With this money we will be able to provide all transport and accommodation for the visiting students and provide the full range of activities such as fieldtrips and company visits we have planned. We would be very grateful to receive individual company contributions starting at £250 (bronze), £500 (silver) or £750 (gold). In return we will be pleased to display your company logo on all our chapter resources, including our website, any presentations and documents. Additional benefits for gold and silver sponsorship will include full/half page adverts in course material for gold and silver, we would be happy to distribute any promotional material on your behalf to participants and members of our chapter and for gold sponsors to send HR representatives to meet the course participants.

We would greatly appreciate your support in this initiative and look forward to hearing from you at your earliest convenience.

Concluding remarks

We at the Aberdeen AAPG Student Chapter committee would like to thank you once again for your generous sponsorship of our student chapter and enabling us to host a very successful fieldtrip. We shall continue to promote your companies at student chapter events and on our website until the end of the year, after this your logos will still be present on a section of our website with details of the fieldtrip. We hope you will continue to support our chapter's upcoming events and we look forward to working with you in the future.

Thank you for your support,

The Aberdeen Student Chapter committee

Adam McArthur (President), Mark McKinnon (Vice President) Paula Robinson (Secretary) Ben Kilhams (Webmaster) and Natalie Salter (Treasurer).

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<http://www.abdn.ac.uk/geology/pg/aapgsc/aapgsc.php>