

PIP

Petroleum
Infrastructure
Programme



Monday 17th October 2011 Atlantic Ireland 2011

Burlington Hotel
Upper Leeson Street, Dublin 4

A Petroleum Conference
Organised by PIP-ISPSG

A one-day conference and exhibition on Ireland's offshore hydrocarbon potential

Abstracts Volume



This annual event is organised by the
Petroleum Infrastructure Programme (www.pip.ie)

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ATLANTIC IRELAND 2011

A One Day Conference and Exhibition on
Ireland's Offshore Hydrocarbon Potential
Sponsored by PIP-ISPG

PROGRAMME & SHORT ABSTRACTS

Location: Burlington Hotel, Dublin, Ireland

Date: 17th October 2011 – 08.30 to 19.00hrs

Audience: Researchers, exploration companies, geophysical contractors, government departments & agencies, international guests.



Edited by:

Martin Davies & Tom Moore

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ION-GXT – Tea & Coffee Breaks



IHS – Session 4 Prospects 2 Go



Shell – Delegate Bags

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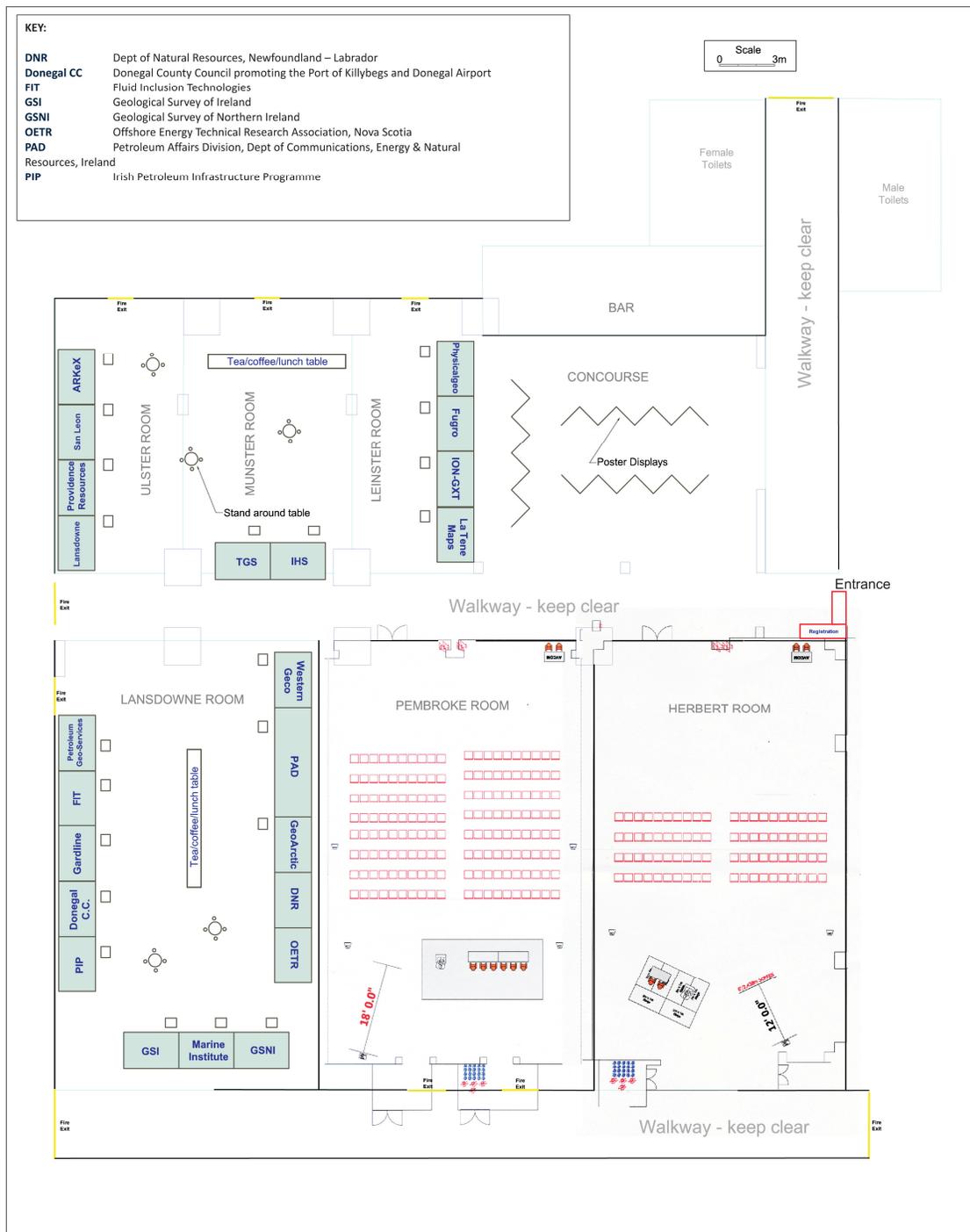
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Exhibition Layout





CENTRAL & NORTH ATLANTIC

CONJUGATE MARGINS CONFERENCE
DUBLIN 2012

THIRD CONJUGATE MARGINS CONFERENCE 2012

SCOPE OF THE CONFERENCE

The Conjugate Margins Conferences aim to bring together new data and ideas on the evolution of sedimentary basins in the Atlantic margins, with a focus on comparisons of the petroleum systems of this underexplored province.

WHO SHOULD ATTEND

Those interested in hydrocarbon exploration and research on the Central and North Atlantic Conjugate Margins, including E&P companies, geological and geophysical contractors, consultants, university researchers, government agencies and departments.

CALL FOR PAPERS

TRINITY COLLEGE DUBLIN, IRELAND
WEDNESDAY 22ND AUGUST-FRIDAY 24TH AUGUST 2012

www.conjugatemargins.ie



Monday 17th October 2011 Atlantic Ireland 2011

Burlington Hotel
Upper Leeson Street, Dublin 4

A Petroleum Conference Sponsored by PIP-ISPSPG

Oral Programme

Monday 17th October 2011

07.30 - 08.55	Registration - Coffee / Tea available in Exhibition Room and Poster Room
08.55 - 09.00	Opening remarks
09.00 - 09.15	Address by Minister for Natural Resources (DCENR) - Pat Rabbitte, TD
09.15 - 09.30	Atlantic exploration and petroleum research overview – Noel Murphy (DCENR), Viv Byrne (PIP-ISPSPG)
Session 1 - Plate Reconstruction	
Chair: Jonathan Craig (ENI)	
09.30 - 10.10	Deformable plate reconstructions provide new insights into the structural evolution of the North Atlantic between Ireland and Canada - Bridget Ady (GeoArctic)
10.10 - 10.40	Crustal structure, subsidence history and stretching within the basins bordering the conjugate North Atlantic margins of Ireland and Newfoundland - Alan Roberts (Badley Geoscience Ltd.)
10.40 - 10.55	Discussion
10.55 - 11.30	Coffee Break
Session 2 - Petroleum Systems Analysis	
Chair: Hamish Wilson (Consultant)	
11.30 - 11.50	Lower Cretaceous Petroleum Systems of the Porcupine Basin – Andre Stout (Physicalgeo Ltd)
11.50 - 12.10	Play Fairway Programme, offshore Nova Scotia - Sonya Dehler (on behalf of OETR, Offshore Energy Technical Research Association)
12.10 - 12.30	Topographic and climatic controls on regional sediment dispersal into NW European Triassic basins - Shane Tyrrell (University College Dublin)
12.30 - 12.50	The plate tectonic, palaeogeographic and palaeoclimatic context for the development of the North Atlantic conjugate margin basins: Exploration concepts and petroleum play fairway mapping - Jim Harris (Fugro-Robertson)
12.50 - 13.00	Discussion
13.00 - 14.10	Lunch Break - Sandwiches Served In Exhibition Room

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Monday 17th October 2011 Atlantic Ireland 2011

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Upper Leeson Street, Dublin 4

**A Petroleum Conference
Sponsored by PIP-ISPSPG**

Session 3 - New Data, New Technologies (Parallel)

Chair: John Conroy (Shell Exploration and Production Ireland Ltd.)

- 14.10 - 14.30 A new interpretation of the key seismic traverses across the Rockall Trough and Porcupine Basin, and the nature and origin of the Porcupine Median Volcanic Ridge (PMVR) - Menno Dinkelman (ION-GXT)
- 14.30 - 14.45 Exploration strategy and current activity offshore Newfoundland and Labrador – Ian Atkinson (Nalcor Energy)
- 14.45 - 15.00 Sediment sources, transport paths and supply evolution in the Upper Jurassic of the northern Porcupine Basin; new evidence from the Pb isotopic composition of detrital K-feldspar - Áine McElhinney (University College Dublin)
- 15.00 - 15.15 Proposed new WARRP surveys offshore both Ireland and Canada - Brian O'Reilly (Dublin Institute of Advanced Studies), Kim Welford (Memorial University) and Pat Shannon (University College Dublin)
- 15.15 - 15.30 The value of rich azimuth seismic data acquired on 3D line turns – experience from recent surveys offshore Ireland - Keith Byrne (Providence Resources)
- 15.30 - 15.45 The nature of Cenozoic strike-slip faults in the Irish Sea and Northern Ireland; a multi-data interpretation – Hugh Anderson (University College Dublin)
- 15.45 - 16.00 The INFOMAR programme, the Griffiths Awards and other Irish marine research - Koen Verbruggen (Geological Survey of Ireland)

Session 4 - Prospects 2 Go (Parallel)

Chair: Iain Sinclair (Husky Energy)

- 14.15 - 14.30 Prospects 2 Go, Steve Boldy (Lansdowne Oil and Gas)
- 14.30 - 14.45 Prospects 2 Go, John O'Sullivan (Providence Resources)
- 14.45 - 15.00 Prospects 2 Go, Agnieszka Slowik (San Leon Energy)
- 15.00 - 15.15 Prospects 2 Go, Graham Pritchard (Serica Energy)
- 15.15 - 15.30 Prospects 2 Go, Dave Davies (Sosina)
- 15.30 - 15.45 Prospects 2 Go, Andre Stout - North & South Porcupine prospects
- 15.45 - 16.00 Prospects 2 Go, TBA

16.00 - 16.30 Tea / Coffee Break

Session 5 - Poster Session

Chair: Pat Shannon (University College Dublin)

- 16.30 - 17.30 Poster presenters are asked to stand by their posters and to make a brief presentation on their project.

17.30 - 19.00 Reception in Exhibition and Poster Area

Atlantic Ireland 2011

This annual event is organised by the
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ORAL ABSTRACTS (in order of presentation)

Speaker is underlined

Atlantic exploration and petroleum research overview – Time for innovation

Murphy, N.¹; Byrne, V.²

¹ *Petroleum Affairs Division, Dept. Of Communications, Energy and Natural Resources*

² *PIPCoRSG Ltd*

The Atlantic Basins off the west coast of Ireland are under-explored, having seen very limited drilling and a variable coverage of seismic surveys. This talk will outline recent exploration developments offshore Ireland, including the success of the Government's new licensing initiatives, which will hopefully mark the beginning of a new era of increased exploration activity.

The importance of international petroleum research collaboration will be emphasised, along with the essential role being played by the Petroleum Infrastructure Programme (PIP) - another Irish Government initiative - in the promotion of Ireland as a prime region to explore for oil and gas. The Programme is fully in keeping with the Government policy objective of encouraging investment in oil and gas exploration and is aligned e.g. with the Irish Energy Research Council's strategic objective to stimulate the private sector to explore for indigenous hydrocarbon resources by reducing the level of uncertainty that affects hydrocarbon prospectivity.

The Petroleum Infrastructure Programme is currently focussing on the use of newly developed software, geological data and innovative analytic techniques to define the pre-rift architecture and geological history of North Atlantic basins in much greater detail than has hitherto been possible.

The Programme is truly innovative in its approach and demonstrates an exceptional level of collaboration between industry, academia and government. PIP projects exploit and integrate existing and new data and technology to provide exploration solutions. It manages major new data acquisition projects and supports innovative geoscience modelling techniques. This research activity stimulates foreign direct investment in Irish hydrocarbon exploration.

This conference will demonstrate the contribution PIP is making to our understanding of petroleum potential. It will also show how the Programme is facilitating hydrocarbon exploration here and some of the drilling prospects currently on offer to the industry.

Deformable plate reconstructions provide new insights into the structural evolution of the North Atlantic between Ireland and Canada

Ady, B¹; Whittaker, R.¹

¹GeoArctic Ltd, Calgary, AB, Canada

A team of leading researchers from academia, government, and industry on both sides of the Atlantic has recently completed the first year of a two-year study to develop *A New Kinematic Plate Reconstruction of the North Atlantic between Ireland and Canada*. The project team, which is led by GeoArctic Ltd, includes researchers from Badley Geoscience Ltd., University College Dublin (UCD), Memorial University of Newfoundland (MUN), University of Liverpool, the Dublin Institute of Advanced Studies (DIAS), the Geological Survey of Canada (GSC), and others.

The plate kinematics of the North Atlantic Ocean has been well documented and there is general agreement that extension started in the Triassic and lasted until the Tertiary, with final separation between the Flemish Cap and Galicia Bank occurring in the Early Cretaceous and between Greenland and the Hatton Bank in the Palaeogene. Understanding the tectonic history of the conjugate margins of Newfoundland and Ireland is critical for evaluating their hydrocarbon potential and, as petroleum exploration has focused increasingly on deep-water continental margins in recent years, plate tectonic reconstructions are coming into their own as an important exploration tool. Current plate kinematic models for the North Atlantic are inadequate when it comes to understanding the pre-breakup history of the region and its influence on basin geometry. It is critical, therefore, that we better understand the pre-breakup history and employ plate reconstruction tools and techniques that are up to that challenge.

The current study benefits from the deformable plate reconstruction method developed by GeoArctic in the late 1990s (Whittaker et al, 2000) that eliminates many of the inherent short-comings found in rigid plate reconstructions. The method advances ideas first put forward by Srivastava and Verhoef (1992) for the removal of extension at plate margins. However, their earlier approach used a gross estimation of continental lithosphere extension (β factors) from the measurement of plate overlap, which did not accommodate lateral, depth-dependent, and time-dependent variations in the amount and direction of extension or movement in the vertical plane due to tectonic subsidence. Whittaker et al (2000) first describe a 4D deformable plate reconstruction that used as input β factors for key time intervals calculated from 3D tectonic subsidence maps. This method has since evolved to include the wide range of geological processes responsible for basin development as well as analytical techniques that include 2D or 3D gravity inversion, flexural backstripping and forward modelling in the calculation of vertical movement and lateral, depth-dependent, and time-dependent variations in the amount and direction of extension. For this study gravity inversion, flexural backstripping and forward modelling have been carried out by Badley Geoscience Ltd. (Roberts et al, 2011).

A robust deformable plate model may be used to accurately remove the effects of pre-breakup extension across conjugate margins thereby providing a means to better evaluate basin formation and evolution and takes into account the wide range of geological processes responsible for basin development. Ultimately, the ability to apply the deformable plate model to restore, not only the palaeo-position, but the pre-breakup geometry of basins, palaeogeography, structure, sediment source areas, and reservoir facies represents a major advance over rigid plate models in the evaluation of source rock and reservoir potential. The new kinematic model for the North Atlantic between Ireland and Canada resulting from this study will provide us with an enhanced understanding of the major controls and mechanisms for basin formation and evolution in offshore Atlantic Ireland and Eastern Canada.

Crustal structure, subsidence history and stretching within the basins bordering the conjugate North Atlantic margins of Ireland and Newfoundland

¹Roberts, A.; ¹Alvey, A.; ²Kusznir, N.; ³Whittaker, R.; ⁴Stolfova, K.

¹*Badley Geoscience Ltd.*

²*University of Liverpool*

³*GeoArctic Ltd., Calgary, Canada*

⁴*University College Dublin, Ireland*

As part of the North Atlantic plate reconstruction project we have investigated the crustal structure of the major basins which border the conjugate margins of Ireland and Newfoundland. We have done this via three independent analyses of available 2D and 3D data:

1. 3D gravity inversion, using public domain gravity and sediment-thickness information, has produced maps of (i) depth to Moho, (ii) crustal thickness and (iii) stretching/thinning factor across both margins
2. 2D gravity inversion, using public domain gravity data combined with new proprietary sediment thickness information, has produced a series of cross-sections showing (i) depth to Moho, (ii) crustal thickness and (iii) stretching/thinning factor across both margins
3. 2D backstripping and forward modelling has been used to produce (i) estimates of stretching/thinning factor, (ii) whole-crustal cross-sections and (iii) predictions of palaeobathymetry through time along a series of project-specific transects.

The 2D gravity inversion and the geodynamic modelling have both used a new set of depth-transects (11 for Ireland, 6 for Newfoundland) produced during the seismic-interpretation phase of the North Atlantic project. The 2D gravity inversion uses the interpreted sediment thickness from seabed to top-basement as a primary input, the geodynamic modelling uses the full horizon-by-horizon stratigraphy.

Key to both the gravity inversion and the geodynamic modelling is an ability to allow for the contributory effects of new volcanic addition (leading to new ocean-crust formation) when estimating stretching/thinning factors. This can make a significant difference to stretching/thinning predictions across the outer margin areas. In addition, both the 2D and 3D gravity inversion methods include a lithosphere thermal gravity-anomaly correction in their calculations, allowing for the elevated geotherm which results from the rifting/breakup process.

Our combined analysis, which is internally consistent across the techniques applied, shows stretching/thinning across the basins of the conjugate margins to be markedly heterogeneous. Areas of relatively shallow bathymetry, e.g. Hatton Bank, Porcupine Bank, Goban Spur (Ireland); Jeanne D'Arc and Whale/Horseshoe Basins (Newfoundland), are unsurprisingly characterised by low-to-moderate thinning factors, for which the observed upper-crustal faulting can explain the observed subsidence. Areas of deep bathymetry, e.g. Rockall Trough, Porcupine Basin (Ireland), East and West Orphan Basins (Newfoundland), are characterised by high thinning-factors, typical of continental margins. In these areas it is difficult to reconcile the observed magnitude of upper-crustal faulting with the observed subsidence.

In areas where there is an apparent discrepancy between the observed upper-crustal faulting and the predicted amount of crustal thinning, we believe that the lithosphere-scale process of Depth-Dependent-Thinning (DDT) may have operated. DDT is believed to be characteristic of the breakup process at rifted margins worldwide. The inference that DDT has operated within the conjugate paired basins of Rockall – West Orphan and Porcupine – East Orphan suggests that each basin pair represents a failed attempt at breakup prior to the eventual Ireland/Newfoundland separation which cut across these previously-formed failed-breakup basins.

Lower Cretaceous petroleum systems of the Porcupine Basin

Stout, A.

Physicalgeo Ltd.

Physicalgeo Limited undertook a complete evaluation of the Porcupine Basin in early 2011, to support the Atlantic Margin licensing round. This utilised all available seismic data, and built on many years of research into the structural and stratigraphic development of the basin. The results of this work highlighted potential play fairways at many levels. One of the most interesting play fairways was that of the Lower Cretaceous, both in terms of potential reservoirs and source rocks.

The Lower Cretaceous section of the Porcupine Basin is usually classified as post rift - sag infill of a deepwater basin, following the syn-rift tectonics of the Late Jurassic. A broad range of depositional settings have been identified, from marginal marine shoreface systems to deepwater turbidite and basin floor packages. There are very few well penetrations that have intersected the more basinal Lower Cretaceous sequence, and these only exist in the North Porcupine Basin, with most wells drilled on structurally positive features. Therefore, seismic data has been used to indicate potential reservoir and source rock facies in the basin.

In addition to reservoir fairway analysis, evidence has been collated that supports the presence of a Lower Cretaceous source rock in the basin. Tectonic reconstruction allows drilled analogies to be presented that give compelling indications of the presence of source rock intervals that correlate with global anoxic events. This is further supported by seismic data, where reflection character can be used to characterise the presence of source rocks. Significantly, these source rocks are very likely to be in the oil window over most of the basin.

Sequence stratigraphic subdivision of these clastic fairways has revealed potentially isolated low stand systems that could potentially create stratigraphic traps. Such trapping configurations have proved successful in the Lower Cretaceous discoveries off the West African and South American transforms at Jubilee and Zaedyus respectively. This potential is further enhanced through the identification of seismic amplitude anomalies in these settings.

The Lower Cretaceous of the Porcupine Basin represents a virtually untested play fairway that has many parallels to the recent large discoveries on the Central Atlantic transform margins and could offer a new lease of life to this underexplored region.

Play Fairway Programme, offshore Nova Scotia

Dehler, S.¹

¹*Geological Survey of Canada on behalf of the Offshore Energy Technical Research Association*

The Play Fairway Analysis (PFA) program is a large research program, funded by the government of Nova Scotia, with the goal of stimulating renewed offshore petroleum exploration activity. Started in 2008, the PFA brought together 25 companies and more than 100 researchers from universities, government research labs, and industry. Key elements of the program include projects in plate tectonics, salt modelling, biostratigraphy and reservoir quality, all of which fed into an industry standard play fairway analysis. The bulk of the work is complete, and an atlas is being prepared that summarizes all of the results, including gross depositional environment and common risk segment

maps. Highlights include the development of a new sequence stratigraphic framework for the basin, based on a comprehensive analysis of biostratigraphic and seismic data, and the refinement of the tectonic model of evolution for the margin. The PFA model predicts two source rock types and three main play systems on the margin, extending prospectivity outside the Sable delta region.

Topographic and climatic controls on regional sediment dispersal into NW European Triassic basins

Tyrell, S.¹; Haughton, P.D.W.¹; Shannon, P.M.¹; Daly, S.J.²

¹*UCD Sand Provenance Centre, School of Geological Science, UCD, Belfield, Dublin 4, Ireland*

²*National Centre for Isotope Geochemistry, School of Geological Sciences, University College Dublin, Belfield, Dublin 4, Ireland*

The Northwest European Triassic succession comprises the Early – Middle Triassic Sherwood Sandstone Group (SSG) and the Middle – Late Triassic Mercia Mudstone Group. These represent the deposits of large-scale endorheic drainage systems which accumulated in the arid to semi-arid interior of the Pangaeon Supercontinent and infilled a series of wide, extensional rift basins. Provenance analysis of SSG equivalent sandstones in a range of basins, from the southern UK through to the northeast Atlantic Margin, has allowed regional Triassic palaeodrainage patterns to be constrained. This approach utilises the Pb isotopic of detrital K-feldspar which is an abundant framework grain in these sedimentary rocks.

When integrated with current Triassic palaeogeographic and climate models, the results suggest that both topography and flooding associated with an annual monsoon are likely to have been responsible for pre-sorting and ultimately transporting sediment from upland areas. This combination of processes can also account for the textural maturity, mineralogical sub-maturity and generally good reservoir quality of the sandstones. Significantly, the data highlight the presence of two distinct drainage domains: 1) the 'Budleighensis' domain, where systems flowed from south to north and were derived and controlled by the remnant Variscan Uplands; and 2) the Atlantic Margin domain, where drainage was oriented NW-SE and sediments were dominantly derived from the Archaean-Palaeoproterozoic rocks of Greenland and the Rockall Bank. The drainage divide separating these domains coincides with the Irish and Scottish massifs. Although these areas were of sufficient relief to act as a drainage barrier, they themselves were not a significant clastic source.

The Plate Tectonic, Palaeogeographic and Palaeoclimatic context for the development of the North Atlantic conjugate margin basins: Exploration concepts and petroleum play fairway mapping

Harris, J.¹; Anderson, E.¹; Muñoz, A.A.¹; Crossley, R.¹; Glover, C.¹; Stronach, N.¹; Valdes, P.²

¹*Fugro-Robertson Limited*

²*University of Bristol*

For frontier basins, the development of petroleum play concepts is difficult and in particular, the presence of source rocks and reservoirs represents some of the main uncertainties for exploration. To provide an objective, process based, predictive methodology focused on these problems, global plate reconstructions were used as the basis for palaeogeographic mapping. These maps are underpinned by data and were coupled with state-of-the-art palaeo-Earth systems models (HadCM3 palaeoclimate model). Detailed palaeotectonics and palaeoenvironments maps were prepared and a new method relating topography and bathymetry to plate tectonic environments was used as the basis for palaeo digital elevation models (DEMs). These were gridded in GIS and used to provide the topographic and bathymetric boundary conditions for coupled ocean-atmosphere general circulation models (GCMs), and a barotropic model to simulate palaeotides. The compilation of the base maps was based on a global database of palaeoenvironmental and lithofacies data, the legacy of over 25 years of petroleum geological studies and an equally extensive source rocks database. These data include climate proxies that were used to test the veracity of the modelling results. Together with Plate Wizard™ reconstructions, this work is used to provide an understanding of the palaeogeographic and palaeoclimatic geohistory of the North Atlantic. It also provides key petroleum play concepts and constraints on play fairway mapping, illustrated here for North Atlantic basins.

A new interpretation of the key seismic traverses across the Rockall Trough and Porcupine Basin, and the nature and origin of the Porcupine Median Volcanic Ridge

Dinkelman, M.¹; Calves, G.²; Huuse, M.³

¹*ION-GXT*

²*Université de Toulouse, UPS-CNRS-IRD, Toulouse, France*

³*School of Earth, Atmospheric and Environmental Sciences, University of Manchester, Manchester, UK*

The NE Atlantic continental margin encompasses two distinct types of rift- induced structures: magma-rich margins and magma-poor marginal basins. The occurrence of significant volcanism in the evolution of sedimentary basins can in some cases be unraveled based on the analysis of reflection seismic images. The NE Atlantic margin from Norway to western Ireland shows extensive evidence of volcanism related to Paleogene rifting. Older, magma-poor marginal basins are observed eastward toward the European mainland whereas younger Tertiary magmatism affected the entire North Sea continental shelf.

This presentation is in two parts: in the first part we will show a number key seismic strike and cross lines through the Rockall Trough and Porcupine Basin showing crustal structure and stratigraphy incorporating recently developed ideas and concepts about basin formation on magma poor margins. The seismic data convincingly demonstrate the extreme crustal stretching and thinning down to 2-4 kms in the Rockall Trough and Porcupine Basin with extensive volcanism and the Moho rising to as

little as ± 5 kms. The focus of the second half of this presentation is on the development of the Porcupine Median Volcanic Ridge, using various criteria such as internal geometry and velocity structure revealed by the deep seismic data. The analysis indicates that the ridge is an extrusive tholeiitic volcanic ridge constructed by stacked hyaloclastic deltas, deposited close to sea level.

The results invalidate the rotated fault-block and serpentinite mud-volcanic origins for the ridge suggested by some previous studies. The magnitude of the extension suggests a hyper-extension setting where limited mantle serpentinisation may have occurred, but serpentinite does not make up the PMVR.

Exploration strategy and current activity offshore Newfoundland and Labrador

Atkinson, I.

Nalcor Energy Oil and Gas Inc.

Newfoundland and Labrador currently produces over 290,000 barrels of oil per day (C-NLOPB August 2011 production data) from three main fields and two satellite fields – Hibernia, Hibernia South, Terra Nova, White Rose and North Amethyst. The Hebron Field is in the planning/design phase with the first oil scheduled for 2017.

The Canada-Newfoundland and Labrador Offshore Petroleum Board carries a resource estimate of over 11 Tcf of natural gas that has been identified by existing wells. The 4.2 Tcf of gas that has been identified off Labrador is from wells that were drilled in the 1970's and early 1980's. There is considerable upside for natural gas in the province's offshore, but to date the resources remain stranded.

Exploration activity in the offshore has increased in recent years and this has led to the deep water discovery, Mizzen, in the Flemish Pass Basin and the new satellite possibilities in the Jeanne d'Arc Basin. However, large unexplored and under explored areas exist off Labrador, the Grand Banks and Western Newfoundland. Nalcor has implemented a strategy to improve our knowledge of the petroleum systems and plays in these basins to help reduce exploration risk and attract new players to the region. This strategy involves both the acquisition of new data and the re-evaluation of older data. Nalcor has partnered with companies, governments and research institutes to achieve this goal. The objective is to create an environment for vigorous, multi-basin exploration activities that will result in new discoveries and developments to arrest the production decline curve of the existing fields.

*Nalcor Energy Oil and Gas Inc. Is a crown corporation of the Government of Newfoundland and Labrador.

Sediment sources, transport paths and supply evolution in the Upper Jurassic of the northern Porcupine Basin; new evidence from the Pb isotopic composition of detrital K-feldspar

Mc Elhinney, Á.; Tyrell, S.; Houghton, P.D.W

UCD Sand Provenance Centre, School of Geological Science, UCD, Belfield, Dublin 4, Ireland

Provenance studies help in constraining palaeogeography and sediment dispersal to ancient basins and can have important implications for the distribution and quality of potential hydrocarbon reservoirs. Sources, sand-entry points, palaeodrainage and routing within and between Jurassic basins west of Ireland are poorly constrained. Pb isotopic composition of detrital K-feldspar can provide useful constraints and help resolve many of these issues.

This study investigates the provenance, palaeogeography and palaeodrainage of the Upper Jurassic reservoir sandstones in well 35/8-2 in the northern Porcupine Basin. The Pb composition of detrital K-feldspar is determined using LA-MC-ICPMS (laser ablation multi-collector inductively coupled-plasma mass-spectrometry). A previous study of K-feldspar from Upper Jurassic sandstones in the northern Porcupine Basin suggested derivation from the Porcupine High to the north, but was based on few (<40) analyses. The new Pb isotopic data (334 analyses) have also been integrated with MLA (Mineral Liberation Analysis) tallies of the grain types to provide a more robust interpretation. The aim is to investigate whether the Pb signal is consistent across a wider stratigraphic interval and between different depositional elements.

These new data indicate the presence of four Pb clusters, each attributed to a discrete basement source and include previously unrecognised grain populations. The vertical distribution of Pb data show the relative contribution from the main sources varied through time recording the evolution of sediment supply to the deep-water northern Porcupine Basin. This gradual change in provenance may reflect increased lateral input, perhaps linked to local rifting associated with the early formation of the Rockall Basin.

Proposed new WARRP surveys offshore both Ireland and Canada

O'Reilly, B.¹; Welfords, J.K.²; Shannon, P.S.³

¹*Geophysics Section, Dublin Institute of Advanced Studies (DIAS)*

²*Department of Earth Sciences, Memorial University of Newfoundland*

³*UCD School of Geological Sciences, University College Dublin*

The acquisition of wide-angle seismic profiles in the Irish offshore began in the 1970s across the broad region between the Celtic Sea and the Hatton Continental Margin. These were targeted to address outstanding scientific questions concerning lithospheric development and sedimentary basin structure in the North Atlantic region. This acquisition continued through the 1990s into the present century in the deep-water Rockall and Hatton basins, with the most recent data (2002 -2004) being gathered in the Porcupine Basin. These controlled source experiments resolved details of structure, hitherto unknown, within the crust and Mesozoic to Recent sediments. They have led to the development of new ideas regarding the mechanisms of extension in passive margin hyper-extended crust.

One of the main results to emerge from this substantial body of work was that continental lithosphere extends unbroken from Ireland to the Hatton Continental Margin. The process of continental break-up and sea-floor-spreading did not begin until the early Eocene and had a major stratigraphic impact on the post-Mesozoic evolution of the Irish margins. Crustal thickness varies widely (~2 km to 32 km)

with the thinnest crust occurring below the Rockall and Porcupine basins, where exhumation of serpentinised cold mantle lithosphere sporadically occurs.

Magmatic underplating, associated with early Cenozoic volcanism, is confined to the outer fringes of the Hatton Continental Margin. The insights into the geologically protracted development of the Irish continental lithosphere have been important in developing scientific understanding of extensional tectonic processes. The data have yielded new information of the likely sedimentary thickness and regional sedimentary architecture of the frontier Atlantic margin basins. They have also contributed much to our regional understanding of the petroleum systems and hydrocarbon potential of the Irish offshore. The resulting data and scientific publications led to the development of new concepts and understanding in the mechanisms of hyper-extended crust in passive margins and in the regional architecture and thermal history of the resulting basins.

Critical scientific questions have arisen from this early pioneering research. These regard how the conjugate North American (Canadian) and Western European conjugate continental margins fitted together and evolved tectonically in the geological past. Answering these questions has implication for the development of linked proven hydrocarbon systems within the North Atlantic region. A new integrative approach to margin reconstruction is required to understand the interlinked syn-rift tectonic/seismic-stratigraphic development of the entire system.

The objectives of a current proposal for the acquisition and interpretation of a set of new profiles are to fill critical gaps in base-line information on the structure and physical properties of the upper lithosphere, and on the broad sedimentary succession, in key areas of the conjugate margins. The data acquired will be a fundamental ingredient in reconstructing the late Palaeozoic to early Mesozoic thermal and tectono-stratigraphic evolution of the North Atlantic region. The results will be complemented by, and will also guide, other studies (e.g. basement isotopic provinces, Triassic and Jurassic sediment transport patterns and provenance studies, and also high-resolution biostratigraphy/chronostratigraphy).

A key part of this approach is the combined use of long-streamer low frequency airgun sources, with ocean bottom seismometer systems to resolve both shallow and deep structure. The frequency bandwidth can be further significantly increased below very low frequencies (~ 2 - 3 Hz) generated by controlled underwater sources with information carried by ultra-low frequency (< 0.1 Hz) passive teleseismic sources, generated by distant earthquakes.

The value of rich azimuth seismic data acquired on 3D line turns – experience from recent surveys offshore Ireland

Byrne, K.

Providence Resources Plc.

Providence was recently involved in three new 3D seismic surveys offshore Ireland where it was deemed necessary to acquire data in a full azimuth mode as the most cost effective acquisition method for enhanced target illumination. This method involves acquiring the data in a series of overlapping circles, often referred to as coil acquisition. Concerns regarding repeatability of the survey for 4D seismic purposes and potential increased streamer noise lead Providence to rely on a classic acquisition method of straight lines in a race track fashion. Outside the primary 3D area, “rich azimuth” coil acquisition was tested by acquiring seismic data on line turns, targeted specifically at areas with poor imaging on existing vintage 2D seismic data.

Pre-survey issues and concerns with the coil acquisition included gun maintenance, potential high levels of noise on the streamers, recording capabilities and ultimately processing. The resulting data coverage varies between three surveys from seven to forty two rich azimuth lines. Data from a 2009 Porcupine Basin survey was processed through PreSTM as 2D data yielding excellent data quality which exceeded expectations. Imaging in poor data areas was significantly improved and provided critical regional context to the core 3D seismic survey. Post survey timing analysis from the surveys acquired in the Porcupine Basin (280 sq km & 225 sq km) as well as the North Celtic Sea Basin (235 sq km) show approximately fifty percent of operational time is spent on line turns. Rich azimuth acquisition outside the primary 3D area therefore significantly increases vessel efficiency by providing additional geophysical data.

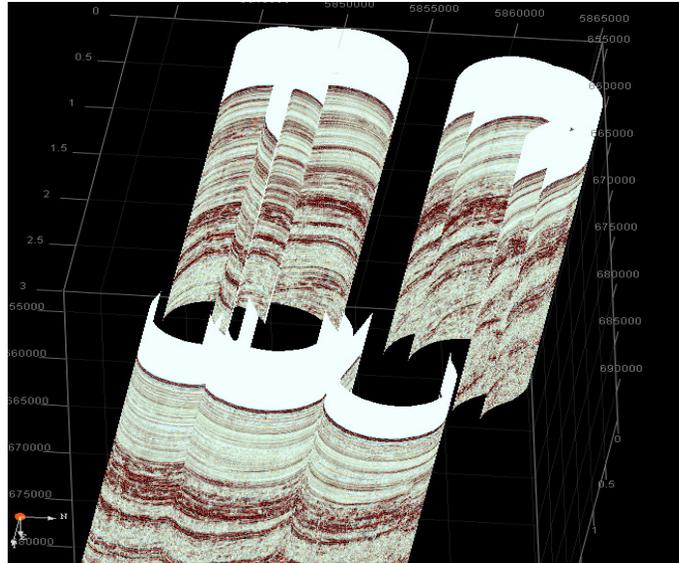


Figure 1 - Example 3D visualisation of rich azimuth data

The nature of Cenozoic strike-slip faults in the Irish Sea and Northern Ireland; a multi-data interpretation

Anderson, H.; Walsh, J.J.

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The Tellus aeromagnetic dataset suggests the existence of a conjugate strike-slip fault system in Northern Ireland from the Palaeogene through to the Oligocene times. Kilometre scale displacements are observed along two dominant trends, with NNW-SSE trending dextral faults offsetting igneous complexes in the east, and with NE-SW sinistral faults reactivating older Carboniferous and Caledonian structures and displacing broadly contemporaneous Palaeogene dykes. This structural configuration is supported by interpretation of 2D and 3D seismic datasets further to the south within the Irish Sea, with the NNW-SSE trending Codling Fault accommodating km-scale dextral displacements and representing the lateral equivalent of similar structures, referred to as the Newry and Camlough Faults, observed onshore. This strike-slip fault system has been attributed to Alpine-related N-S regional shortening.

Detailed mapping of both onshore and offshore faults has highlighted the presence of a variety of associated accommodation structures along their length. The Codling fault is characterised by arrays of minor riedel strike-slip faults and by the presence of pull-apart basins, as expected, along right-stepping bends. Similarly onshore accumulations of Oligocene sediment are associated with left-stepping bends along the NE-SW striking sinistral Tow Valley fault. Combined with evidence suggesting that igneous complexes could be spatially associated with, and perhaps even controlled by, the Newry/Camlough faults, there are strong grounds for suggesting that strike-slip faults are accompanied by associated volumetric strains which localise both sedimentation and igneous activity. Potentially the most profound impact of this fault system is seen, however, in the Lough Neagh area where the principal strike-slip conjugate faults intersect and the thickest accumulations of both Palaeogene basalts and Oligocene sediments are found. This structural configuration is attributed to right stepping of major dextral strike-slip fault across a reactivated sinistral strike-slip fault, leading to stretching which is coincident with the conjugate fault intersection and the related pull-apart.

The INFOMAR programme, the Griffiths Awards and other Irish marine research

Verbruggen, K.¹;

¹*Geological Survey of Ireland (GSI)*

INFOMAR, is Ireland's national marine mapping programme, funded by Government and implemented as a joint venture between the Geological Survey of Ireland (GSI) and the Marine Institute and is the successor to the Irish National Seabed Survey (INSS). Covering some 125,000 square kilometres of underwater territory, the INFOMAR project will produce integrated mapping products covering the physical, chemical and biological features of the seabed.

The surveys are carried using a range of platforms, including the Marine Institute's RV Celtic Explorer and RV Celtic Voyager, inshore launches and Airborne LIDAR. The programme uses ship-mounted acoustic multibeam sonar and geophysical technology to provide vital information on water depth for safe shipping, as well as analyse the properties of the seabed for information that can guide fishing, ocean renewable development, environmental protection, marine archaeology and all offshore development. The data is made available free of charge via the web.

GSI are also involved in a number of European marine projects of relevance to the offshore petroleum industry:

EMODNET. The European Commission, via the Directorate-General for Maritime Affairs and Fisheries (DG MARE), has concluded service contracts for creating pilot components of the **European Marine Observation and Data Network** (EMODnet). The overall objective is to create pilots to migrate fragmented and inaccessible marine data into interoperable, continuous and publicly available data streams for complete maritime basins. The results will help to define processes, best technology and approximate costs of a final operational European Marine Observation and Data Network. GSI are involved in projects relating to both Hydrography and Geology, producing new broad scale compilations of bathymetric and geological data respectively.

GEOSEAS. Geo-Seas, funded under FP7, is implementing an e-infrastructure of 26 marine geological and geophysical data centres, located in 17 European maritime countries. Users are enabled to identify, locate and access pan-European, harmonised and federated marine geological and geophysical datasets and derived data products held by the data centres through a single common data portal. In Ireland, the marine Institute, UCC and GSI are linked to this data network. In addition to the infrastructural components, Geoseas is also supporting new open source viewers to access a range of data, including seismic archives, and well logs.

NAG TEC. Northeast Atlantic Geoscience Tectonostratigraphic Atlas, is an initiative of the Geological Surveys of NW Europe. Modelled on the successful STRATAGEM Project, this 3 year project, which is co-funded by the Surveys and Petroleum Industry, will develop a comprehensive and up-to-date Tectono-stratigraphic Atlas of the region. The Atlas will provide; a quantitative analysis of key basin parameters, regional correlations of key stratigraphic units, unconformities, and geologic formations, an understanding of the connectivity and similarities between known prospective regions and unexplored areas and comprehensive analysis of conjugate margin pairs

The Griffith Awards are a national geoscience research award scheme, administered by the GSI and funded under the National Development Plan. A number of the funded projects have relevance to the petroleum industry, particularly those being undertaken at UCD School of Geological Sciences and NUIG Earth and Ocean Sciences.

In a summary of the ongoing activity of GSI and their partners in this sector, reference will also be made to sources of further information and future plans.

Prospects 2 Go (Lansdowne Oil & Gas)

Boldy. S.

Lansdowne Oil & Gas

ABOUT LANSDOWNE OIL & GAS

Lansdowne Oil & Gas plc is an independent oil and gas exploration company listed on the AIM market of the London Stock Exchange since April 21st, 2006 (Symbol:LOGP). Lansdowne has its operating headquarters based in Dublin, Ireland.

Lansdowne is focused on oil and gas exploration and appraisal opportunities in the shallow water North Celtic Sea Basin ("NCSB") offshore southern Ireland, which contains proven oil and gas petroleum systems.

Lansdowne has an extensive acreage position, amounting to around 500,000 acres, and operates acreage in both the Cretaceous oil and gas plays and the Upper Jurassic oil play (Fig.1).

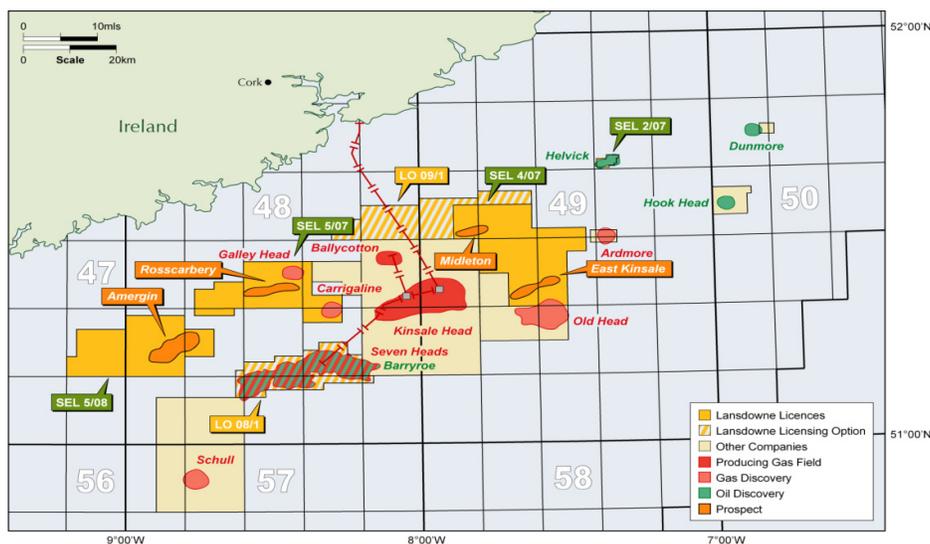


Fig.1 North Celtic Sea Basin Location Map showing Lansdowne acreage

Lansdowne also participates (20%) in the Barryroe Oilfield, operated by Providence Resources, where three wells drilled previously have proven oil productive horizons beneath the Seven Heads gas-field and tested at flow rates of between 1,300 bopd and 1,600 bopd.

Lansdowne has targeted the NCSB for exploration and exploitation as it considers this proven oil and gas productive, shallow water basin, relatively underexplored in the context of the North Sea neighbouring basins.

RECENT ACTIVITY

Historically, exploration in the Celtic Sea has been hampered by the poor quality of the seismic data, largely attributable to the presence of a hard chalk seabed that results in multiples that obscure the deeper structure (Figure 2).

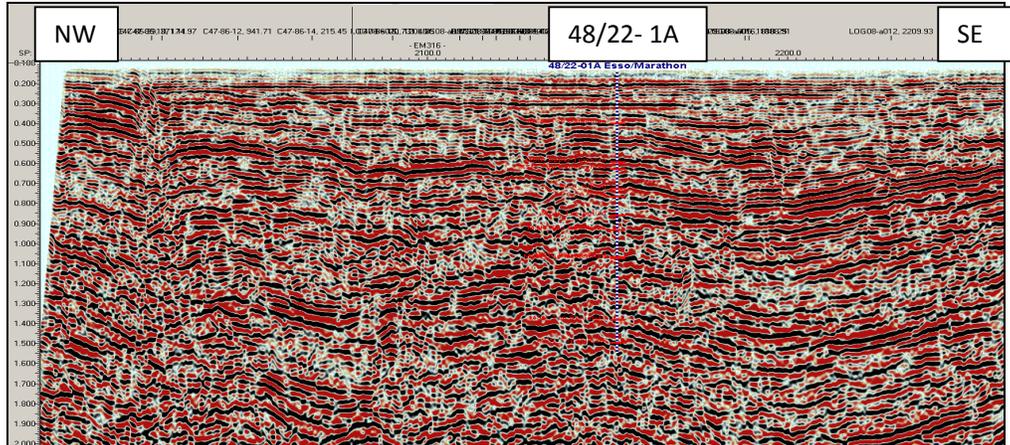


Fig.2 Seismic Line EM 316 – 1970's data through the Amergin Prospect and 48/22-1A well

In 2008 Lansdowne acquired new 2D seismic data which greatly improved the subsurface imaging (Fig.3).

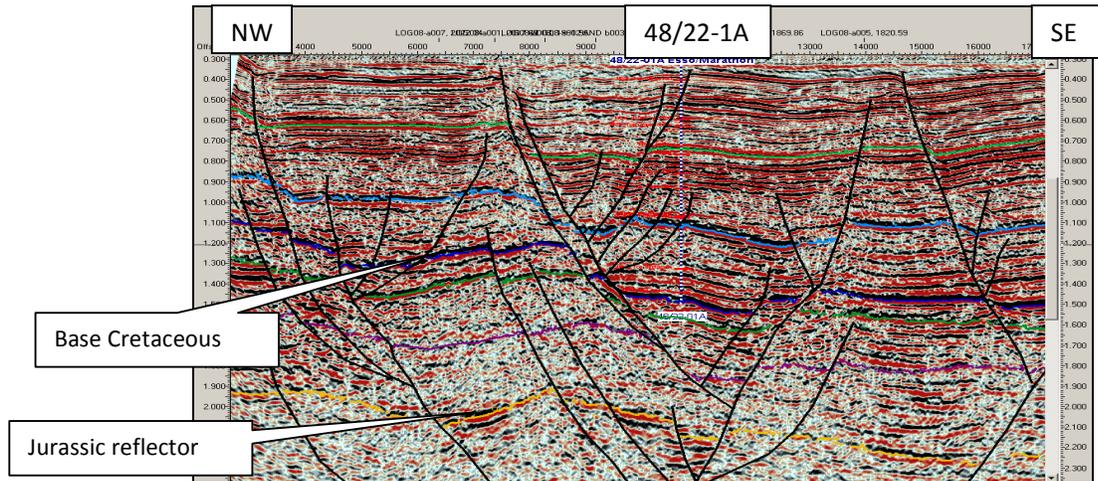


Fig.3. Seismic Line LOG 08 016 through the Amergin Jurassic Tilted Fault Block prospect and the 48/22-1A well

Encouraged by the results of the 2008 2D seismic data, Lansdowne acquired 3D seismic surveys this summer over the Amergin, Rosscarbery and Midleton prospects and also participated in the 3D seismic survey over the Barryroe oilfield, acquired by the Operator Providence.

FORWARD PROGRAMME

Lansdowne will participate in the forthcoming appraisal well on the Barryroe oilfield (Lansdowne 20%). The 3D datasets over the Amergin, Rosscarbery and Middleton prospects are expected to be delivered in November, following which Lansdowne will seek farminees to join the drilling of these prospects in 2012.

Prospects 2 Go

The Dragon field – Seismic inversion breaths fire into dormant gas discovery

O'Sullivan, J.M.

Providence Resources plc

The Dragon gas field was discovered in the St George's Channel Basin (Figure 1) by Marathon Oil in 1994 with the drilling of the 103/1-1 well which was targeting a deep Lower Triassic Sherwood Sst objective analogous to producing oil and gas fields in the nearby East Irish Sea Basin. Whilst the well failed to reach its target objective due to mechanical problems, three hydrocarbon bearing zones were encountered in the overlying Middle-Upper Jurassic section. One of these zones tested at c. 21 MMSCFGD & 120 BOPD demonstrating the presence of a lean high deliverability gas condensate accumulation. Whilst the subsequent 2005 Marathon operated appraisal well 103/1a-2, which was drilled into a separate fault panel to the east of the discovery well confirmed reservoir continuity, it was dry possibly due to either trap failure and/or hydrocarbon migration bypass.

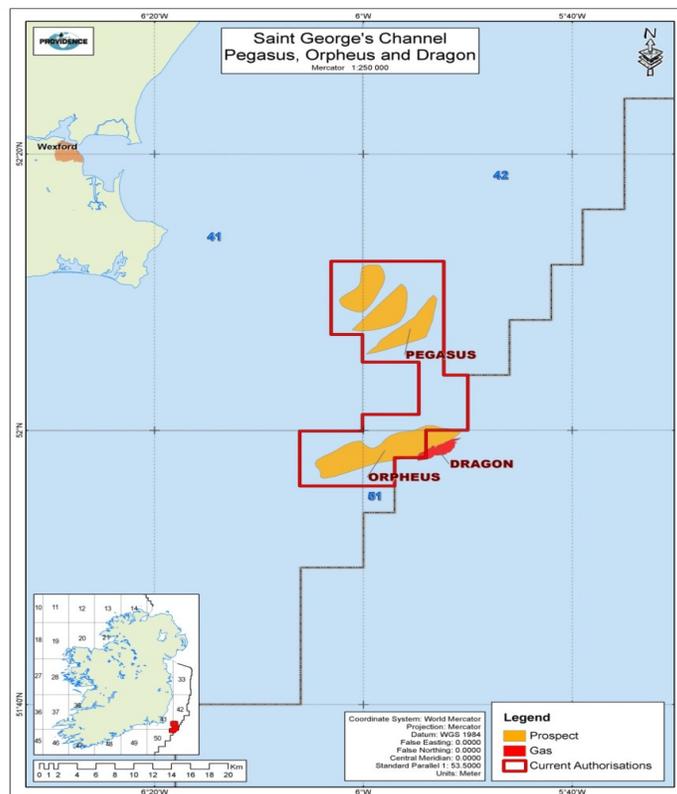


Figure 1 - Dragon area location map

The Dragon gas field is located on an inverted downthrown fault block (Figure 2) to a major intra-basinal fault in the central part of the St George's Channel Basin. The field is situated 40 km offshore south-eastern Ireland in c. 100 metre water depth. The principle reservoir sands of Middle-Upper Jurassic age which were deposited in a fluvial/alluvial/littoral setting with intra-formational shales providing the associated top-seals. Source is considered to be from underlying Lower Jurassic marine shales.

Mapping of the 3D data indicates that the Dragon structure extends from UK block 103/1 into Irish (Providence 100%, Operated) block 51/1. Traditional interpretations of the subsurface data have previously proposed a structural control to the hydrocarbon entrapment with a shared GWC between the two main reservoir zones (3 & 4) and an associated GIIP which ranges up to c. 100 BSCF GIIP. The GRV calculations split c. 25:75 in favour of Ireland and UK respectively. Providence recently applied for UK Seaward block 103/1 as part of a UK Government 'out of round' process which is currently pending environmental assessment.

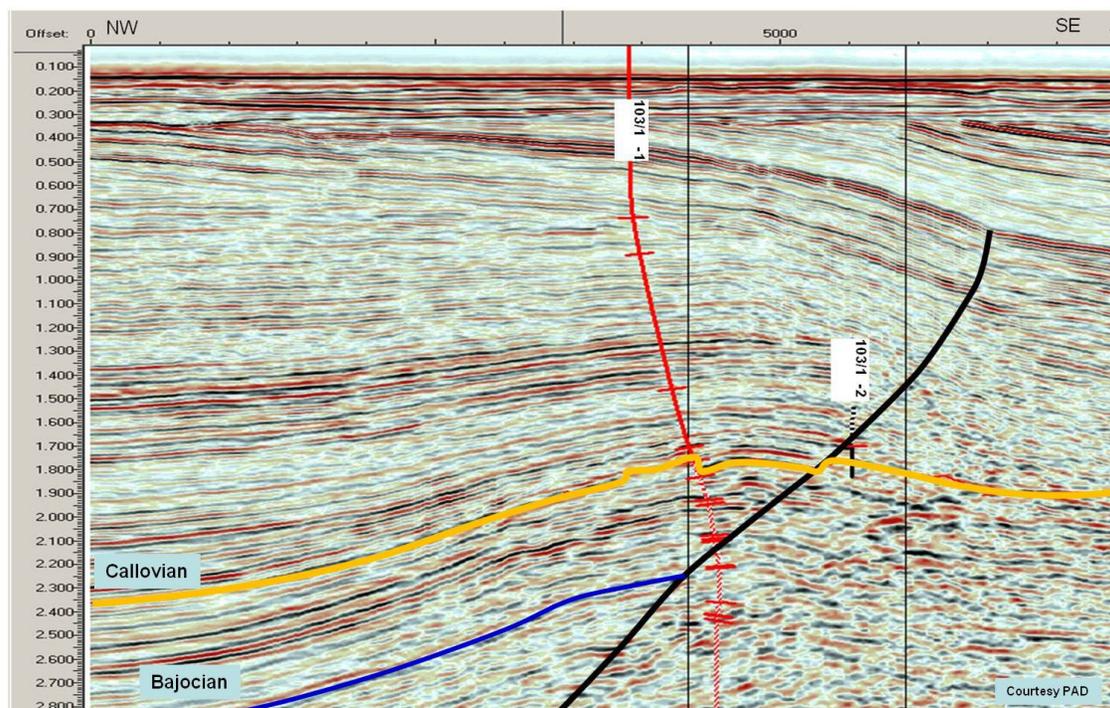


Figure 2 - 3D Seismic inline through the 103/1-1 discovery well (103/1a-2 well projected)

A recently completed Dragon seismic inversion study, which was carried out by IKON Geoscience, involved the modelling of historical well and seismic data using the latest available technology. This study has determined that the presence of the Dragon gas bearing reservoir sands may be directly detectable from the 3D seismic data. Revised mapping using these inverted seismic data indicates that the Dragon gas accumulation may extend further into Irish waters than had been previously been mapped having a potentially stacked stratigraphic trapping element. The new associated potential resource base has been revised up to c. 300 BSCF GIIP with a c. 75:25 resource split between Ireland and the UK emphasizing the importance of the Irish acreage. Additional reprocessing of the 3D seismic data has now commenced as part of the planning of an appraisal well to be drilled in 2012.

Providence commissioned Procyon Oil & Gas to cost up a conceptual subsea development for the Dragon Field. The development concept, which was based on the core 100 BCF GIIP, comprises a single well 70 km subsea tieback to NTS gas infrastructure at Milford Haven, South Wales and provides attractive economic returns. The increased field resource levels indicated by the seismic inversion study should provide further significant upside to the project economics. Providence is now seeking partners to share risk and enable field appraisal to progress this discovery to development.

Prospects 2 Go Licence FEL 4/06 (Slyne)

Slowik, A.

San Leon Energy Plc

Licence FEL 4/06 (Slyne)

San Leon Energy Plc (“San Leon”) and Lundin Petroleum AB (“Lundin”) each own a 50% interest in Frontier Exploration Licence FEL 4/06 which is located in the Slyne basin, off the west coast of Ireland. Following a new 300 sq kilometer 3D survey acquired in August 2010, San Leon and Lundin have identified the Inishmore Prospect, an attractive and material exploration target. FirstEnergy Capital LLP has been engaged as financial advisor for the farm-out of FEL 4/06.

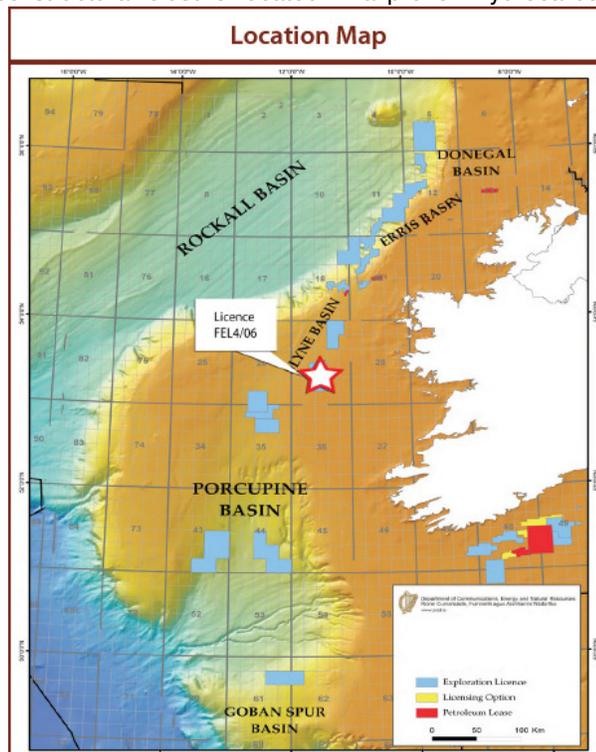
Key Opportunity Highlights

Strategic Opportunity

- Opportunity to farm-in to a large, untested structural closure located in a proven hydrocarbon basin
- Significant equity being made available in return for contribution to well costs, with operatorship potentially being made available to new partner
- Prospect evaluated to mature status and covered by good quality 3D seismic data
- In success case, opportunity for standalone development and potential upside development synergies with other offshore West of Ireland projects
- West coast of Ireland receiving increased industry attention
- An independent development study has been carried out which demonstrates high NPVs and IRRs for the project.

Geology and Resources

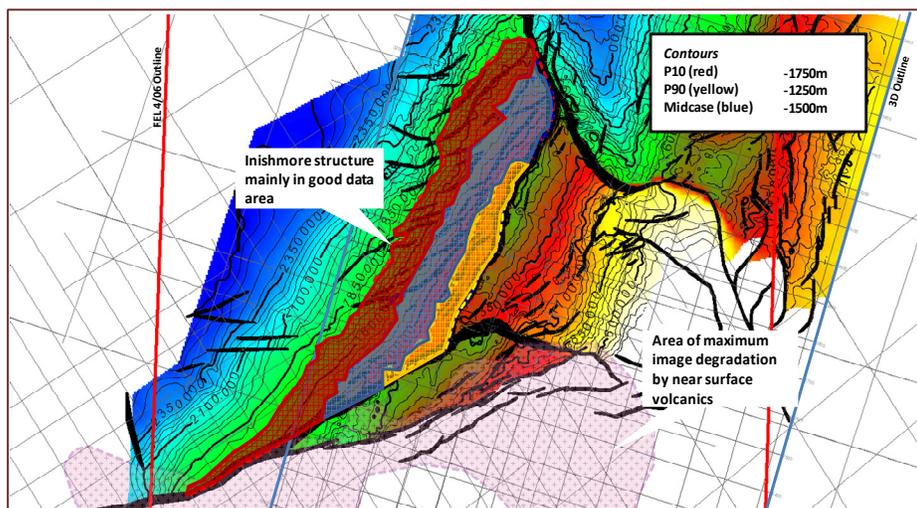
- Inishmore area shares the same geology with the Corrib Gas Field (est. 870 Bcf recoverable)



- GIIP in excess of 1Tcf in the Inishmore Prospect with estimated recoverable prospective resources of ca. 780 Bcf gross (Pmean)

The Inishmore Prospect

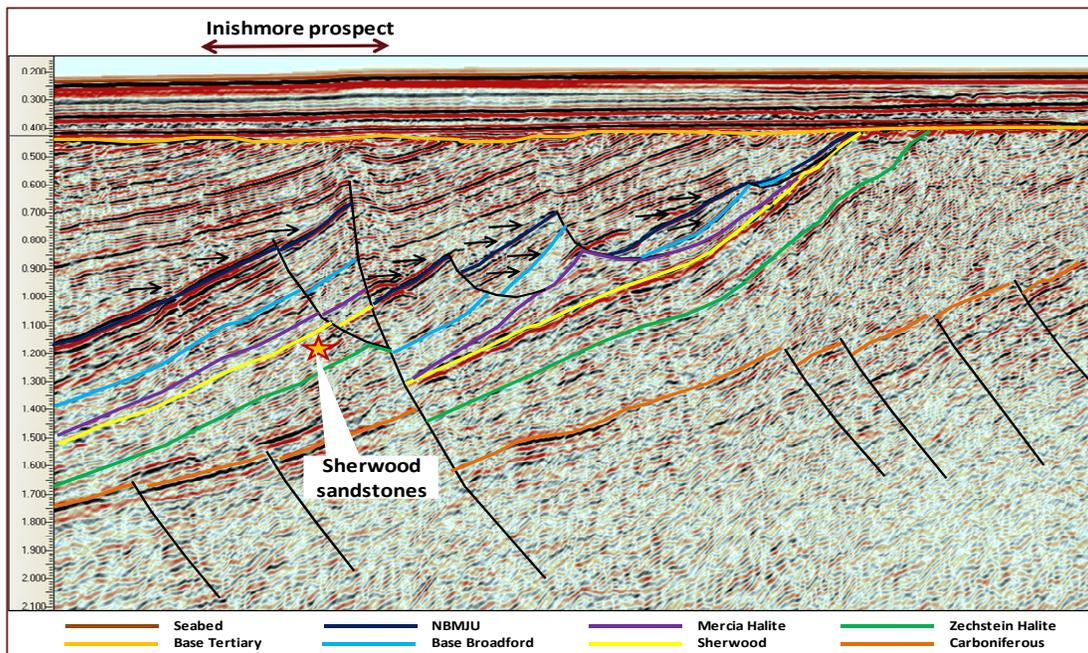
- Geology of the basin well understood with source rock, reservoirs and top seal clearly identified
- Area derisked by 300 km² of good quality 3D seismic data and in depth regional studies
- Inishmore Prospect comprises a large fault bounded structure
- Potentially large in place hydrocarbon volumes in excess of 700MMboe (oil and gas aggregated)



Two Reservoir Targets Identified

- Main objective :
 - Regionally extensive, gas prone Lower Triassic Sherwood Sandstone
 - Gross reservoir thickness of circa 370 m with good reservoir characteristics expected
 - Potential Gross Prospective Resources up to 1.6 Tcf
- Secondary objective:
 - Oil prone Jurassic sandstone

- Gross Prospective Resources up to 180 MMbbls



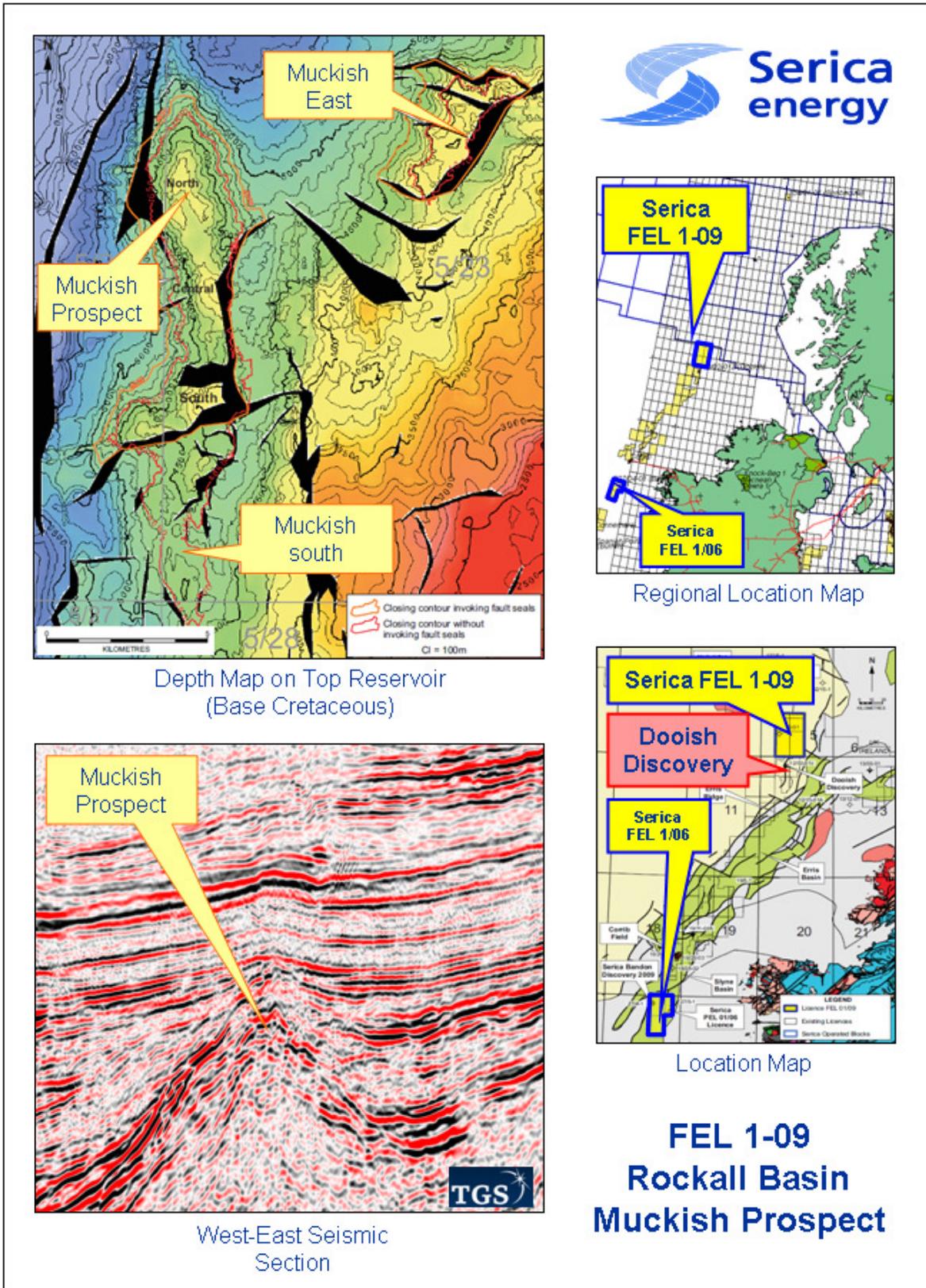
Prospects 2 Go The next big discovery in the Rockall Basin? The Muckish Prospect, FEL 1-09

Pritchard, G.
Serica Energy

Located on the north-west Atlantic margin of Ireland in relatively deep water (500 to >2000m), the Irish Rockall Basin is very poorly explored, having seen only three exploration wells drilled to date. Nevertheless, the 12/2-1,1z Dooish Discovery well (drilled by Shell / Enterprise in 2002-2003) established a proven hydrocarbon system within the basin. The Dooish Discovery reportedly contains approximately 265 bcf + 17 mmbbls wet gas and condensate reserves trapped within “pre-rift” sandstones of Permian to possibly Jurassic age in a large tilted fault and dip-closed structural trap.

Despite the limited well control, this part of the Rockall Basin has good coverage of both 2D regional seismic lines and 3D seismic data, including 2400 km² of 3D seismic data acquired by PGS in 1998 (SRT-98) across and to the north of the Dooish Discovery. Mapping of these data has revealed a number of similarly large structural closures on-trend with and to the north of the Dooish Discovery, including the Muckish Prospect. Muckish is a significant fault and dip closed structure with approximately 25 km² areal closure and hundreds of metres of vertical relief, with estimated reserves (P₉₀ – mean – P₁₀) in the range of 95 – 675 – 5100 bcfe.

Serica applied for blocks covering the Muckish Prospect in the Irish Rockall Basin Licensing Round, and was awarded Licence FEL 1/09 covering Blocks 5/17, 5/18, 5/22, 5/23, 5/27 and 5/28 in July 2009. Recognising that one of the key risks on the Muckish Prospect is the presence of reservoir within the pre-rift section, Serica commissioned the re-processing of the SRT-98 3D seismic data. Serica also sponsored TGS to acquire 1354 km of long-offset 2D seismic data across the area. Both the reprocessed 3D seismic data and the long-offset 2D seismic data have achieved significant



improvements in resolution of the pre-rift section in the Muckish Prospect. The new data indicate the presence of a layered sedimentary section beneath the Base Cretaceous Unconformity, which has substantially reduced the pre-drill risk on the Muckish Prospect.

Prospects 2 Go The Helvick Oilfield – A ready-2-go commercial opportunity in the Celtic Sea

Davies, D.J.¹; O'Sullivan, J.M.²

¹*Sosina Exploration Limited*

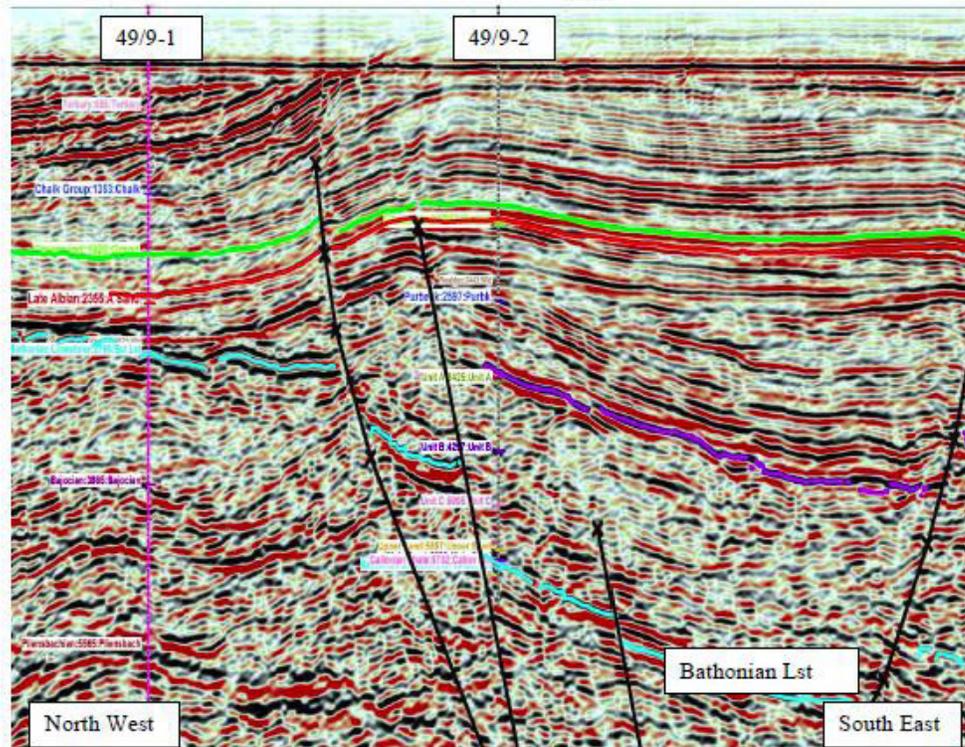
²*Providence Resources plc*

INTRODUCTION

The Helvick oil field was discovered in 1983, testing light (42o API), sweet oil, with high deliverability (9,900 BOPD), but limited in place best case resources (6.3 MMBL STOIP). A recent review by partners (Providence Resources 62.5% (Operator), Atlantic Petroleum 18.3%, Lansdowne Oil & Gas 10% & Sosina Exploration 9.2%) has investigated the possibility of economic development by employing marginal field solutions in the current higher oil price environment. Current audited contingent resources for Helvick are: 1C 2 MMBO, 2C 3 MMBO, 3C 6 MMBO with significant upside potential (best case STOIP of 16 MMBO) in an immediately neighbouring and up-dip fault block.

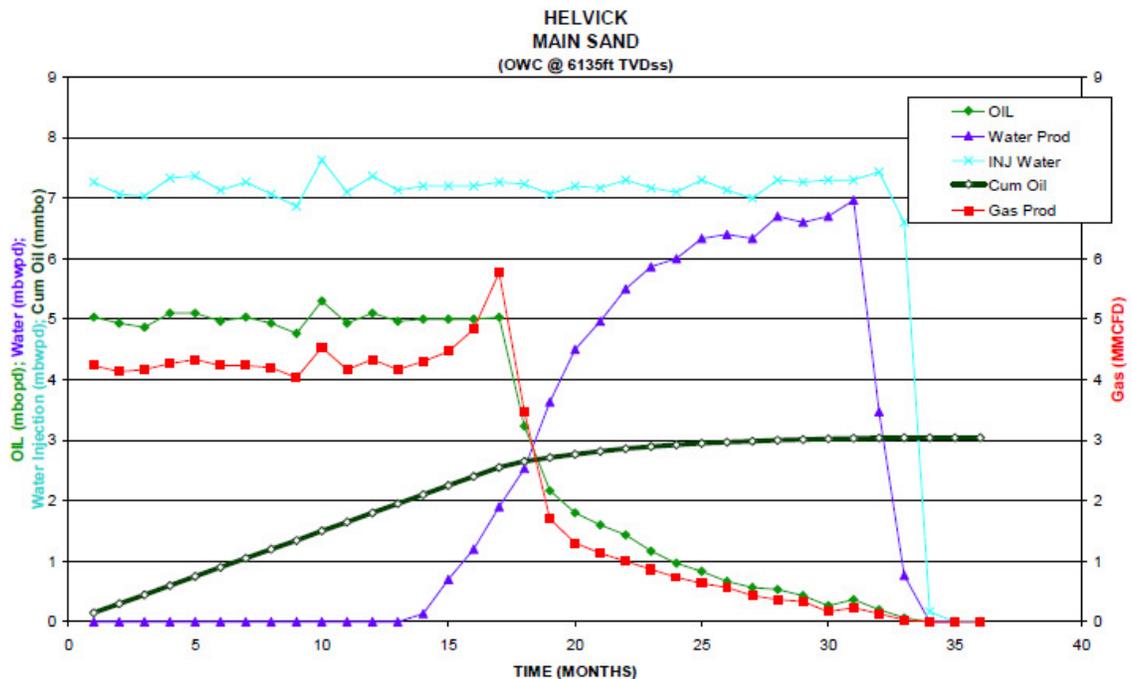
GEOLOGY & GEOPHYSICS

The Helvick field is located in a downthrown fault block on the main basin bounding fault on the northern edge of the North Celtic Sea Basin. The field is situated c. 40 km offshore southern Ireland in c. 80 metre water depth. The principle reservoir sands are of Middle-Upper Jurassic age, which were deposited in a fluvial/alluvial setting with intra-formational shales providing the top-seal. Source is considered to be from underlying Lower Jurassic marine shales. The field contains best case resource of 6.3 MMBL STOIP across three Jurassic reservoir intervals: the (Kimmeridgian) Upper Sand, the (Oxfordian) Main Sand, and the Bathonian Limestone. The Main Sand contains the bulk of these volumes, i.e. 5.1 MMBL STOIP) and importantly is seen as a relatively consistent layer across the whole field area. Significant further upside potential is recognised in the adjacent and up-dip NW Terrace which is calculated to contain circa 16 MMBL STOIP. Two 3D seismic survey's cover the field, shot by Gulf in 1985 and Providence in 1998, (PSTM in 2005-25m inline and 12.5m xline). Some vintage 2D data are also available to help the regional interpretation.



DEVELOPMENT

The 49/9-2 discovery (1983) and subsequent 49/9-6z horizontal wells (2000) are both suspended as oil wells in the Main Sand and are reusable as potential wells, whilst the down dip 49/9-3z is suspended in the water leg, and could be side tracked and used for water injection. Development options screened include fixed platforms & floating solutions. Simulation studies indicate that with down-dip water injection, the Main Sand could achieve a recovery factor of c. 60%. Based on an \$80 oil price, and using recently costed development wells and floating facilities solutions, an attractive NPV10 of up to \$64mm has been calculated based solely on a two well (injector-producer pair) development of just the Main Sand resources, with oil plateau production rates of c. 5,000 BOPD. Further upside production is available from known oil in the overlying Upper Sands and underlying Bathonian Limestone.



CONCLUSION

Helvick potentially represents the first fully commercial oilfield development in the Celtic Sea and is a ready-to-go development. Partners (led by operator Providence) are seeking additional farminees to share risk and commence field development in a 2012-2013 timeframe.

Prospects 2 Go North & South Porcupine prospects

Stout, A.

Licence FEL 1/04 (North Porcupine)

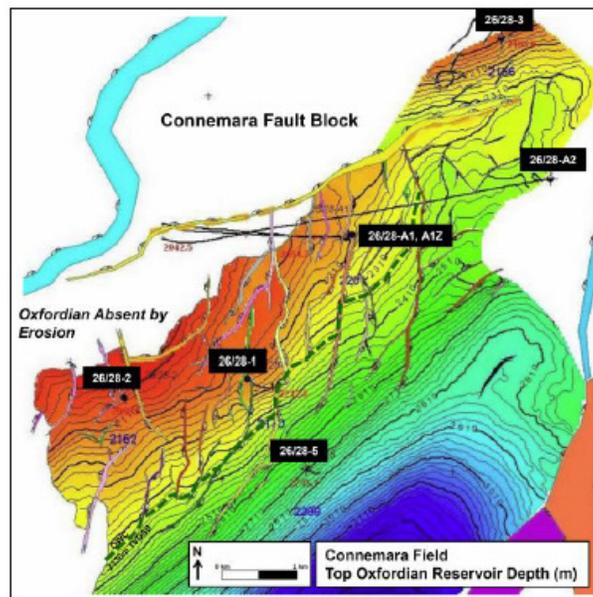
San Leon Energy Plc, Supernova Ireland Resources B.V. and Valhalla Oil & Gas Limited are re-evaluating the entire FEL 1/04 Licence area following the acquisition of a new 220km² 3D survey in May 2011. Significant new potential leads have been identified and interpretation of the new high quality 3D data is expected to be complete by year end. The licence, which is located in the northern part of the Porcupine Basin and is comprised of block 26/28 and part blocks 26/27, 35/2 and 35/3, contains the Upper Jurassic Connemara Oilfield, and a number of high potential exploration prospects and leads. Waters depths vary between 350m and 400m.

- Significant equity will be made available for contribution to well costs, with operatorship potentially being made available to a new partner
- Area covered by 3D seismic data, including recently acquired survey of exploration prospects

- Opportunity to farm-in to a proven discovery at the Connemara field
- Access to additional prospectivity adjacent to this field in proven plays

The Connemara Oil Field

- The Upper Jurassic Connemara Field was discovered by BP in 1979. The 26/28-1 discovery well tested 5589 BOPD from Upper Jurassic sandstones
- Reservoir quality is excellent with core permeability ranging up to one Darcy
- Connemara field has Mid case oil initially in place (OIIP) is calculated to be 151 (mmbbls)
- Initial phase is designed to produce from selected intervals in three out of eight field segments, accessing a total targeted mid case OOIP of 67 mmbbls
- Year one average production of 14-15 thousand barrels per day



Licence FEL 3/08 (South Porcupine)

New work in 2011 has highlighted the potential for oil prone source rocks in FEL 3/08 South Porcupine. San Leon Energy Plc and Supernova Ireland Resources B.V. are offering companies the opportunity to participate in a new 3D survey targeting high impact leads. The licence, which is located in the southern part of the South Porcupine Basin adjacent to the Goban Spur Basin, is comprised of blocks 61/9, 61/10 and 62/6. A recent re-evaluation of the prospectivity has identified potential in pre-rift Triassic, Jurassic plays and at a large post rift Paleocene play.

- Opportunity to farm-in to high impact, high resource prospects in a virgin setting
- Blocks encompass the Tir na nOg high, an intra-basinal high between the South Porcupine Basin and the Goban Spur Basin
- Potential for oil prone source rocks
- Imminent exploration activity in adjacent South Porcupine acreage may open this area to a new phase of exploration

ATLANTIC IRELAND 2011

- Significant equity is being made available in return for contribution to seismic acquisition costs
- Licence commitment to acquire 600km² survey in phase 1

Stands (in alphabetical order)

ARKeX Stand

ARKeX is a leading supplier of gravity and magnetic services to the exploration industry. As well as being a release agent for offshore PAD and DECC gravity and magnetic data, ARKeX can also supply non-exclusive data on behalf of the BGS and most of the major seismic companies. ARKeX offers processing and re-processing of gravity and magnetic data, and are able to merge overlapping data of different vintages into one contiguous data set. Drawing on nearly 25 years industry experience of international projects, ARKeX can interpret integrated potential fields and seismic data to produce geological models in areas where seismic alone is insufficient. In areas of inadequate data coverage, ARKeX is able to acquire both airborne and marine magnetic and gravity gradiometry data.

Donegal County Council Stand

The Donegal County Council stand promotes the facilities in the County available for the offshore oil industry. This includes the deep water port of Killybegs and the airport at Carrickfinn.

Killybegs is a modern, vibrant and forward looking harbour operation. Located in County Donegal in the North West of Ireland it is well placed for servicing offshore energy exploration along Ireland's West Coast and indeed Europe's Western approaches.

Killybegs has deep water all-weather harbour infrastructure along with hydraulic and mechanical services to play a pivotal role in the development of offshore energy. The town of Killybegs has a proud maritime heritage. Developed initially as a fishing port, it has since 1999, played an important role in facilitating offshore exploration and in particular the development of the Corrib Field. It has also been the harbour of choice for wind farm developers, with turbines being delivered for wind farms throughout the north and west of Ireland. In a further development, Killybegs has become the port of call of many cruise ships who benefit from modern berthing and quayside facilities along with direct access to the Highlands of Donegal. Killybegs in essence has evolved into a multifunctional port serving the fishing, energy and cruise sectors. Therefore the presence of this expertise, adaptability and flexibility ensures that Killybegs can meet any challenge. A "can do" attitude pervades.

All the companies listed below have selected Killybegs as their port of choice in support of their offshore activities.

Exploration & Production Companies

Shell
Statoil
Lundin
Serica / AGR
Eni

Subsea / Offshore Construction Companies

Allseas
Technip
Van Oord
Tideway

CTC Marine

Seismic Companies

PGS – Fugro Survey
CGG Veritas – Bergen Oilfield Mgt.
TSS Nopec – Seabird Exploration

Renewable Energy Companies

Enercon
Gamesa
GE Wind Energy
Ocean Energy
Siemens
Vestas
Wavebob
West

In recent years Donegal Airport at Carrickfinn has also provided a hub for the offshore oil and gas industry for many of the major oil Companies. It is strategically located for the support of air services to offshore operations in the West and North West. Helicopters are based at the Airport and fixed wing charters operate to/from Scotland and Norway for the duration of the contracts. Other airport operations include air corps, search and rescue services, private charters and general aviation.

Fluid Inclusion Technologies (FIT) Stand

Fluid Inclusion Technologies (FIT), Inc., is a laboratory-based petroleum service organization offering a variety of analytical services including some previously proprietary technologies. The most widely applicable of these new technologies is *Fluid Inclusion Stratigraphy (FIS)* -- a rapid analytical technique that involves the automated analysis of volatile compounds trapped within micron-sized cavities in rock material taken from well cuttings, core or outcrop samples. These "fluid inclusions" are representative samples of subsurface fluids, and are not subject to fractionation during sampling or evaporative loss during sample storage for any length of time. The new procedure yields valuable information on Pay/Bypassed-Pay, Product Type, Migration, and Seal Integrity, unattainable via more traditional methods and, over the past ten years, has been instrumental in the discovery of significant petroleum reserves, influenced exploration and acreage acquisition decisions and provided innovative options for resource estimation, petroleum production and enhanced oil recovery operations.

An equally impressive aspect of *FIS* technology is the rapid turnaround time: large sample sets (i.e., 100's to 1000's of samples) from single or multiple wells can be analyzed, the results interpreted, and the findings delivered virtually anywhere in the world in a matter of days. Thus, the results can play a crucial role in decision making regarding current plays as well as provide valuable new insights through the analysis of archived cuttings.

The geochemical services offered by **Fluid Inclusion Technologies (FIT), Inc.**, including *FIS Analysis* are variable and problem specific. By combining patented techniques, emerging geochemical methodology and standard microscopic methods, all of which complement each

other, we provide a unique and unequalled industry product. A partial listing of proven applications of our analytical services includes:

- petroleum migration pathway mapping
- characterization of seals to oil and gas
- identification of dry holes proximal to undiscovered hydrocarbons
- delineation of pay or bypassed pay within penetrated sections
- identification of fluid pressure compartments
- characterization of petroleum-water transition zones
- delineation of reservoir compartmentalization.

For further information including applications and more technical aspects of the geochemical and petrological services we provide, please browse through our [**Slideshow Overview of Fluid Inclusion Technologies**](#). This presentation is available on CD and in some cases as a command performance.

Fugro Gravity & Magnetic Services Stand

Fugro Gravity & Magnetic Services is backed by more than 600 professionals at Fugro Airborne Surveys, Fugro Ground Geophysics, and Fugro Gravity and Magnetic Services (formerly Fugro Robertson Inc).

Land Services

Fugro Gravity & Magnetic Services offers its clients a complete suite of Land Services including gravity and electromagnetic techniques.

Airborne Services

Fugro Gravity & Magnetic Services offers high-resolution aeromagnetic surveys, airborne gravity and Falcon™; gravity gradiometry using state-of-the-art equipment.

Marine Services

Fugro Gravity & Magnetic Services offers marine magnetic gravity and bathymetry services.

Interpretation Services

Fugro Gravity and Magnetic Services provide leading edge interpretation of potential field geophysical data.

Software

Fugro Gravity & Magnetic Services provides a complete suite of 2D and 3D modelling and interpretation software for potential field geophysical data.

Non-Exclusive Database

Fugro Gravity and Magnetic Services houses the most comprehensive, privately owned non-exclusive airborne, land and marine potential fields geophysical database in the world. The database incorporates approximately 14,000,000 line kilometres of AeroMagnetic data, 1,200,000 line kilometres of Marine Gravity & Magnetic data, and 2,000,000 stations of land gravity data worldwide. Data may be licensed for entire surveys or for specific areas of interest.

Gardline Stand

The principle member of the GMSL group, Gardline Geosurvey, operates a fleet of dedicated multi-role survey vessels and undertakes contracts for clients that range from offshore exploration, construction and telecommunication companies to government agencies and harbour authorities. The company's key services includes:

- Rig and platform site surveys
- 2D/3D high-resolution data acquisition and interpretation
- Seismic data processing
- Shallow gas hazard analysis
- Pipeline and cable trenching recommendations
- Offshore pipeline route surveys
- Seabed mapping
- Marine cable route surveys
- Hydrographic and geophysical surveys
- Vessel charters

Gardline Geosurvey employs more than 300 permanent staff from a variety of backgrounds and specialisations.

Supported by over 30 years experience in hydrographic and geophysical surveys. Gardline Geosciences incorporates the wealth of geotechnical experience residing in sister - company Lankelma.

As an established player in the worldwide marine geotechnical market, Gardline Geosciences operates the GL 75, a fully heave compensated drill rig, enabling the company to carry out drilling work in water depths down to 400 metres.

For deeper water, the company runs the Deep Water Sampler, an R&D development between the major oil companies, NGI , AP vd Berg and Gardline Geosciences. The Deep Water Sampler currently takes the best quality undisturbed samples of 10 metres long.

The company also has a pool of 12 CPT units and tests of up to 40 metres can be performed with its deepwater CPTs. In addition, specialist vibrocores and seabed sampling systems are also provided. Gardline Geosciences specialises in geotechnical data acquisition using seabed sampling and in-situ seabed testing tools.

Gardline Geosciences carries out geotechnical operations as part of geophysical campaigns of the Gardline survey vessels as well as of third party vessels. Dedicated geotechnical campaigns can be carried out of Gardline Geosciences own dedicated geotechnical vessel

GeoArctic Stand

GeoArctic has provided geoscience consulting and services since 1996. Our consultants specialise in structural geological modelling, palaeogeographic and palaeoenvironmental mapping, and geoscience software development.

Plate models developed by GeoArctic more accurately reconstruct the palaeogeography of the plate margins over geological time. Our specialized plate reconstruction methods have been successfully used for regional studies in oil and gas exploration.

Regional plate reconstructions projects have been completed for the North Atlantic, Norway-East Greenland, Labrador Sea-West Greenland, Eastern Canada-Central Atlantic, Northern Canada and the Arctic and Southeast Asia.

PIP-ISPSG has recently signed a contract to carry out the new Plate Reconstruction of the North Atlantic between Ireland and Canada. GeoArctic are the lead contractor, assisted by Badley Geoscience Ltd in the UK, GSC Atlantic in Nova Scotia and a team of academic experts in Canada, the UK and Ireland. The project will involve research collaboration between Ireland, Canada and several other countries. The work will be funded equally by the government of Newfoundland Labrador through Nalcor Energy and the Irish joint government-industry Petroleum Infrastructure Programme (PIP). The project's objective is to use newly developed software and innovative analytical techniques to define the original architecture and geological history of the North Atlantic prior to the opening of the Atlantic Ocean in much greater detail than has been hitherto possible. The project should provide a powerful new tool to support exploration and help answer questions like "Can the giant discoveries off eastern Canada be replicated on the Irish side?" It is hoped that new insights will emerge that will provide a major stimulus to exploration.

The GeoArctic stand has a series of posters whose abstracts appear in the poster abstract section.

Geological Survey of Ireland (GSI) Stand

The **GEOLOGICAL SURVEY OF IRELAND (GSI)**, founded in 1845, is the National Earth Science Agency. It is responsible for providing geological advice and information, and for the acquisition of data for this purpose. GSI produces a range of products including maps, reports and databases and acts as a knowledge centre and project partner in all aspects of Irish geology. It is a division of the Department of Communications, Energy & Natural Resources (DCENR) and has about 50 multi-disciplinary staff.

Operational Programmes

GSI serves its customer needs through a range of operational programmes and support services:

- The Information Management Programme underpins all of our activities in the delivery of geological information to our customers, and is recognised as the most important corporate priority.
- The Surveying Programmes (Bedrock Geology, Quaternary Geology, Marine Geology and Geophysics) are long-term, and feed information to the Applied Programmes, as well as producing maps and reports used directly by a wide range of external customers.
- The Applied Programmes (Groundwater, Minerals, Geotechnical, Geological Heritage) are largely project-oriented, and provide solutions to specific customer needs, their various activities helping to build their respective databases.

The Geological Survey of Ireland is responsible for gathering, storing and disseminating geological information. It carries out its duties of gathering information by:

- field mapping and recording of data (which **does not** involve topographic surveying - that function is carried out by the Ordnance Survey). This may be

part of a long-term systematic survey, or may take place as part of a specific project, for example a Groundwater Protection Scheme for a particular County;

- the compilation and interpretation of geological data gathered by others. The data may have been collected by university staff or students as part of academic research, it may be open-filed information from Mineral Exploration companies, or it might be reports of geotechnical investigations;
- the drilling of boreholes for stratigraphic data, quaternary sediments or aquifer characteristics, using its own drilling rig.

The GSI maintains an ever-growing store of earth-science information:

- paper maps and reports, ranging from the original sets of six-inch hand-coloured manuscript maps of the 19th Century, through reports submitted to GSI by outside bodies, to published reports and maps;
- physical materials, such rock samples, thin sections, an extensive fossil collection, and an enormous store of drill core;
- a library of earth sciences journals and books;
- digital information, which at present consists principally of metadatabases, but will be complemented over the next few years by digital versions of most current paper reports and maps, together with a country-wide Geographic Information System.

The geological information held by the GSI is used by staff to answer queries, produce reports, and compile special or series maps. The Public may also access these data, either via our free Document Management System or for a nominal handling charge.

Tellus Border is a €5 million mapping project that will collect scientific data on soils, water and rocks across the six border counties - Donegal, Sligo, Leitrim, Cavan, Monaghan and Louth. Information from the project will help manage the environment and support sustainable development of our natural resources. The project is a follow-on from the Tellus project successfully completed in Northern Ireland recently.

Geological Survey of Northern Ireland (GSNI) Stand

The GSNI is part of the Department of Enterprise, Trade and Investment (DETI). It is staffed by scientists of the British Geological Survey (BGS) under contract to DETI, which allows GSNI to call upon expertise from within other parts of the BGS. GSNI also advises other Northern Ireland government departments and liaises closely with the Geological Survey of Ireland (GSI).

What we do

The Geological Survey of Northern Ireland (GSNI) provides geoscience information and services to inform decision making.

Services

GSNI holds an extensive archive of maps, boreholes and site investigation reports; detailed urban and regional geochemical and geophysical data, and publishes books, memoirs and reports.

Science

GSNI maps, models and monitors the ground we live on. Our geological research underpins decision making, promotes economic development and generates baseline data for environmental management.

IHS Stand

Well Data & Seismic - Ireland

[Ireland Well Listing 2006](#)

[Ireland Digital Seismic Data](#)

[Ireland Paper Copy Seismic Data](#)

[Ireland Digital Wireline Data, Well Attributes and Pressure Data](#)

Following a recent agreement with the Irish government, IHS, as official agent to the Irish government, now delivers released digital SEG-Y seismic as well as hardcopy data for the Irish offshore sector. SEG-Y data is deliverable on DVD, multiple CD, 8mm Exabyte or 4mm DAT. Hardcopy data is available on paper or film sepia. Both SEG-Y and hardcopy seismic data is offered on a per line and per survey basis.

SEG-Y data will enable easier and less expensive data transfer, greater integration into technical documentation, and will reduce storage costs in comparison to hardcopy data.

For more information or to place an order, please contact releasedata@ihs.com.

For SubSurface Sales enquiries for Ireland please contact ssg_enquiries@ihs.com.

ION-GXT Stand

ION Geophysical is a leading provider of geophysical technology, services, and solutions for the global oil & gas industry. ION offerings include: seismic data processing solutions, including state-of-the-art depth migration, reverse time migration, and full-wave imaging; regional basin-scale seismic programs comprising a global multi-client data library; software and services for survey design, geophysical analysis, and reservoir modelling; and seismic imaging programs encompassing survey planning, field acquisition, and final image rendering.

Additional information is available at www.iongeo.com.

ION's BasinSPANS™ (SPANS) are geologically-driven, basin-wide seismic data programs acquired and imaged using the most advanced technology available. SPANS allow geoscientists to trace the history of entire petroleum systems to determine where source rocks are most prevalent, where sediment fairways are located, and where the most promising migration paths from source to reservoir exist. Unlike conventional multi-client seismic surveys, BasinSPANS are custom designed in collaboration with ION's GX Technology (GXT), regional experts, and the O&G companies. SPANS are customized to image deep within the geologic section, cover an entire petroleum province, and overlay with areas of heightened structural or stratigraphic interest. BasinSPANS data is processed by GXT using the most advanced geophysical techniques available.

For more information on BasinSPANS visit www.iongeo.com/SPANS. Or email us at BasinSPAN@iongeo.com.

La Tene Maps Stand

La Tene Maps is a knowledge based company based in Dublin, Ireland specialising in the research and production of maps, educational posters and associated data products. The company works mainly in areas which are constantly changing and particularly in the fields of Aquaculture, Fisheries, Oil and Gas Exploration, Renewable Energy, Energy/Power Generation, Marine Environment and Leisure Subjects. We produce and publish a range of maps and posters for clients and ourselves. The company has a whole series of maps covering many parts of the world.

The company is also involved in production of confidential maps and graphics for clients and also sells a small range of maps and posters produced by itself and other companies through its secure online store.

The company's research arm is active in its own right and participates in EU research projects as well as research projects for Government departments, state bodies and private companies.

La Tene Maps has produced every full colour map on the Irish Oil and Gas exploration sector since the Mid 1980's. Today the company specialises in the offshore areas west of Greenwich (UK). The sectors we cover are the UK Irish Sea and South West Approaches; West of Scotland and West of Shetland, the Faeroe Islands and of course the Irish Sector. The company also offers a concession map service to those companies requiring regular updated concession maps.

Printed Oil & Gas exploration maps published by La Tene Maps are available free to bone-fide team members with operators or consortia members working in areas covered by the map. The maps are also distributed free at various conferences and exhibitions. Printed, Digital Print and pdf files are available for purchase by all interested persons.

Projects in Planning Printed Renewable Energy maps published by La Tene Maps are available free to operators of power generating companies in the areas covered by the map. The maps are also distributed free at various conferences and exhibitions. Printed, Digital Print and pdf files are available for purchase by all interested persons.

Marine Institute Stand

The Marine Institute is Ireland's national agency responsible for Marine Research, Technology Development and Innovation (RTDI). They seek to assess and realise the economic potential of Ireland's 220 million acre marine resource; promote the sustainable development of marine industry through strategic funding programmes and essential scientific services; and safeguard our marine environment through research and environmental monitoring.

The Marine Institute worked in partnership with the Geological Survey of Ireland (GSI) on the Irish National Seabed Survey (INSS), a multimillion European initiative supported by the Irish government. The survey aimed to map Ireland's 220 million acres of territorial seafloor, a natural resource that is approximately ten times the size of Ireland's land area.

Phase 1 of the Irish National Seabed Survey (INSS) is now complete, and they are currently in Phase 2: Integrated Mapping for the Sustainable Development of Ireland's Marine Resources (INFOMAR). While Phase 1 concentrated on outer deep-sea territorial waters, Phase 2 has moved inshore to coastal waters. INFOMAR aims to map the remaining 13% of the Irish territorial seafloor, concentrating on specific areas of interest such as priority bays and areas of biological interest.

Newfoundland Labrador Stand

Newfoundland and Labrador has an abundance of oil, natural gas, hydroelectricity and wind resources, as well as the potential to supply energy from other sources such as uranium, biomass, hydrogen, wave and tidal. This substantial inventory of energy sources makes the province an Energy Warehouse that can meet its own energy needs while providing significant energy for export to other jurisdictions where energy demand also continues to grow.

On a per capita basis, Newfoundland and Labrador is the largest producer of electricity and one of the largest producers of petroleum in the world.

The province's total developed clean, renewable electrical generation and undeveloped potential is 18,000 Megawatts (MW), while it requires approximately 2,000 MW to meet its own electricity needs. In addition to clean electrical generation, discovered and potential non-renewable oil and gas resources total over eight billion barrels of oil and 70 trillion cubic feet (tcf) of natural gas. Untapped potential also exists in other energy sources, such as wave and tidal energy, wood, peat, methane captured from landfills and solar energy in some areas.

Three facilities are currently producing oil in the province's offshore region at the Hibernia, Terra Nova and White Rose oil developments. In January 2009, the combined projects achieved a major milestone reaching one billion barrels of oil produced. In addition to these projects, the province recently reached agreements for expansion of the original Hibernia and White Rose developments and a new project, Hebron, is progressing with first oil forecast between 2016 and 2018.

The province also continues to see vibrant oil and gas exploration. The prolific Jeanne d'Arc Basin continues to enjoy active exploration programs by existing and new participants in the province's oil and gas sector. In addition, in recent years, more companies are exploring the deeper waters of the Orphan Basin, Flemish Pass Basin and the Laurentian Basin.

Onshore and offshore western Newfoundland also holds much promise with a number of finds onshore, excellent resource potential offshore and new seismic and drilling programs in both areas.

Newfoundland and Labrador's Energy Warehouse consists of more than developing and producing renewable and non-renewable resources. The province is strategically positioned on international shipping lanes, giving it unique access to global petroleum markets, a key benefit for the province's 115,000 barrel per day oil refinery. There is also a three-million-barrel transshipment terminal that services the offshore petroleum industry. To facilitate the province's primary and secondary energy projects, and to increase benefits from their development and operation, Newfoundland and Labrador can complete large-scale fabrication projects at a number of facilities throughout the province.

Nova Scotia / OETR Stand

OETR is a not-for-profit corporation dedicated to fostering geosciences research that will enhance Nova Scotia's offshore petroleum exploration and development.

OETR's members include Dalhousie University, Saint Mary's University and the Nova Scotia Department of Energy.

OETR's mandate is to fund and encourage research that builds geoscience knowledge about Nova Scotia's offshore oil and gas potential, as well as research that reduces the technical and engineering barriers to the development of discovered reserves.

The stand displays a series of posters produced during the OETR Program and also displays posters from OETR's partners – GSC Atlantic and the Nova Scotia Department of Energy

The OETR stand has a series of posters whose abstracts appear in the poster abstract section.

PAD / DCENR Stand

The role of the Petroleum Affairs Division (PAD) is to maximise the benefits to the State from exploration for and production of indigenous oil and gas resources, while ensuring that activities are conducted safely and with due regard to their impact on the environment and other land/sea users.

The functions of the Division are carried out through a number of strategies with the following objectives:

To maximise the area of Continental Shelf jurisdiction:

establish and delineate an undisputed outer limit of the continental shelf

To license private enterprise to conduct exploration and production (E&P) under terms which balance the interests of the State and of private enterprise while ensuring that:

there is effective and efficient E&P
operations are carried out in accordance with best practices
there is effective liaison with the E&P industry

To have the opportunities maximised for Irish business/institutions to service the needs of E&P in Ireland by:

facilitating the establishment of a mechanism whereby Irish goods and services get
opportunities to participate in exploration activities offshore of Ireland

To provide stimuli for medium and long-term exploration efforts in Ireland by:

securing Irish E&P industry assistance towards building up the local E&P-related
infrastructure, and working with the Irish E&P industry to have research and joint
research and data-gathering carried out.

The Division is responsible for the promotion, regulation and monitoring of the exploration and development of oil and gas in onshore and offshore Ireland. This involves the allocation of acreage to exploration companies under various types of licences agreeing appropriate work programmes and the promotion of acreage, either through open access or by a Round system.

Promotion

identification of areas with potential
preparation of interpretative reports [over such areas]
encouraging companies to acquire new data in such areas
release of basic geological, geophysical and well data to the industry

Regulating

agreeing with operators work programmes which are appropriate for the type of and the area to be licensed while taking account of both the operator's and the interests

Monitoring

ensuring that agreed work programmes are carried out in accordance with good oilfield practice, having particular regard to safety, the environment and other land sea users.

The PAD Stand will display a series of posters covering promotion of exploration in Ireland's waters and PIP-related project posters. The abstract for the Petroleum Systems Analysis posters can be found under Ternan in the poster abstracts section.

Petroleum Geo-Services Stand

Petroleum Geo-Services (PGS) possesses the world's most extensive 3D MultiClient data library comprising over 400,000 km² worldwide. Additionally the developing MultiClient 2D portfolio (200,000 km) is available in frontier and developing hydrocarbon areas and includes a growing proportion of GeoStreamer® data that demonstrates excellent imaging qualities.

PGS flagship MultiClient products include the MegaSurvey, MegaSurveyPlus and MegaProject data packages which provide contiguous 2D and 3D coverage across vast areas.

Recent work by PGS in Ireland has focused on the Atlantic Margin MegaProject. A large database of 2D and 3D seismic data has been assembled from released datasets and PGS MultiClient surveys. All the data has been matched, merged and balanced to provide a regionally consistent, coherent seismic dataset.

The Atlantic Margin MegaProject is being offered for licensing in time for the 2011 Atlantic Margin Licensing Round and includes 4,700 km² of high end 3D MultiClient data, a comprehensive 2D data package and four regional gridded horizons.

PGS Reservoir has provided a regional interpretation and high level prospectivity review of this dataset and will be presenting this with a poster summary at the Atlantic Ireland 2010 Conference.

Physicalgeo Stand

We are a small yet dynamic and driven oil and gas consultancy based in Berkshire. Our focus is on quality geoscientific commercial consulting, non-exclusive reports and software provision.

The principal consultant, Andre Stout, has been serving the community for over 14 years, for majors, minnows and all in between. He has a track record as an oil finder and is in high demand for his services.

Andre has worked on the Atlantic Margin from the Barents Sea to West Africa for companies such as Shell, BP, Chevron, Total, Maersk, Tullow and Nexen. He is familiar with the elements required for successful evaluation of potential; from field development and appraisal through to new basin entry.

Andre is a member of the SEG, EAGE and PESGB.

Contact Andre directly on andre@physicalgeo.com

Further business support is provided by Alison Egan, a marketing specialist with a history of excellent client management. She initially trained in Retail Management and followed this with a Diploma from the Chartered Institute of Marketing.

Contact Alison directly on alison@physicalgeo.com

Other specialists in the oil and gas industry are brought in as required, from data analysts to commercial engineers, using a network of trustworthy contacts.

South Porcupine Basin: Seismic interpretation and evaluation of prospectivity

In order to support the industry in the forthcoming 2011 license round (closing on May 31st 2011) and two high profile farm-in opportunities, Physicalgeo have prepared a comprehensive evaluation of this untested Mesozoic rift basin. We have accessed ALL available seismic data (100,000km+) over this huge area and are in a unique position to support you in your evaluation of this exciting province.

The South Porcupine Basin, sometimes known as the Porcupine Seabight Basin, is a deepwater basin, 150km to the southwest of the Irish coast. Similar petroleum systems are present to those found in the shallower water North Porcupine Basin, where oil and gas fields have been discovered. Crucially, there is potential for better reservoir quality and more numerous source rocks than found in the North Porcupine Basin. Although oil, gas and seismic amplitude anomalies do exist in this basin, proving a working petroleum system at many levels.

Also, the Porcupine Basin is NOT affected by the level of igneous intrusives as seen in other Atlantic Margin basins. The 'igneous' provinces recognised by previous authors are potentially structural features, salt intrusions and mud volcanoes!

PIP Stand

The Petroleum Infrastructure Programme (PIP) was set up by the Petroleum Affairs Division (PAD) in 1997. PIP presently comprises two sub-programmes:- the active Petroleum Exploration and Production Promotion and Support (PEPPS) and the now completed PIP (1997 - 2002) sub-programmes.

The overall aim of PIP is to promote hydrocarbon exploration and development activities by:

- Strengthening of local support structures
- Funding of research data gathering and 'land-based' research in Irish offshore areas
- Providing a forum for co-operation amongst explorationists and researchers

Research under the Programme goes beyond normal licence area-specific work and is designed so as not to duplicate the efforts of other groups or of commercial contractors. It is also considered essential that local researchers should be given an opportunity to participate in the research projects. PIP is funded by oil companies with licences offshore Ireland and the PAD.

Providence Resources Stand

Providence's strategy has been to assemble a portfolio of producing assets in geo-politically safe areas, with a portfolio of offshore and onshore prospects, combining existing discoveries with large new prospects to improve overall economics and reduce risk profile.

The Company also continues to evaluate acquisition of international prospects and niche business ventures in countries where Providence has strong links. Providence's objective is to acquire strategic prospects and realise value to generate sustainable incremental wealth for the company and its shareholders.

A key strand in Providence's strategy revolves around the exploration and exploitation of the hydrocarbon potential around the island of Ireland. Ireland is an area that has limited hydrocarbon commercial developments, (relative to other north west European countries, such as the United Kingdom and Norway) despite a number of exploration successes over the past 40 years, certain macro elements have changed the operating environment and there is now increased international interest in Ireland. These macro elements include attractive fiscal terms, new technology, the installation of infrastructure (and connectivity to the UK and onwards to mainland Europe) and higher commodity pricing.

As a result of these elements, where "the market has moved to us", Providence is currently embarking on the most ambitious multi-basin, multi-year drilling programme to test the true hydrocarbon potential. This programme, expected to last over two years, will be the largest concerted drilling programme ever carried offshore the island of Ireland and will comprise a mixture of appraisal/development drilling on proven discoveries as well as exploration drilling.

Ireland Operations

CELTIC SEA

Standard Exploration Licence 2/07

HOOK HEAD (72.5%, Operator)

The Hook Head oil discovery lies approximately 60 km off the south coast of Ireland and is situated in c. 70m water depth. The Hook Head structure is a large mid-basinal anticline where four wells have been drilled to date, all of which encountered hydrocarbon bearing sands. Two of these wells were drilled by Providence in 2007/08 with oil and gas encountered in both, although operational constraints resulted in limited test data. Further evaluation of the field suggests that the majority of the resource (estimated at c.120 MMBO) lies in the central part of the structure, with the north and south flanks providing additional potential incremental resources for any future development in the area. This central area will be the focus of any planned future drilling. Providence has an option to use the GSF Arctic III rig to drill an appraisal well at Hook Head. This option must be declared once the Barryroe appraisal well has been spudded.

Partners in the project include, Atlantic Petroleum and Sosina Exploration.

DUNMORE (72.5%, Operator)

The Dunmore discovery is located approximately 20 km north of the Hook Head discovery. The discovery well, 50/6-1, was drilled by the then Operator, Gulf Oil in 1985/86, and flowed at a rate of approximately 2,100 BOPD of high quality (44^o API) oil. During 2008, Providence drilled the 50/6-4 appraisal well on the Dunmore structure and whilst the well failed to prove the lateral extent of the hydrocarbon bearing Upper Jurassic sands, a new oil bearing carbonate interval was intersected. Studies in relation to this new oil bearing zone are presently ongoing.

Other partners in the project include, Atlantic Petroleum and Sosina Exploration.

HELVICK (62.5%, Operator)

The Helvick oil field is located in block 49/9, some 36 kilometres off the south coast of Ireland. The Helvick discovery well, 49/9-2, was drilled in 1983 and flowed at a cumulative rate of c. 9,900 BOPD and 7.5 MMSCFGD. Three appraisal wells were drilled in the late 1980s to delineate the field. In 2000, Providence drilled the 49/9-6Z well which was tested at rates of c. 5,200 BOPD. Further detailed analysis indicated that the Helvick reservoir is compartmentalised and would require further appraisal, particularly in the surrounding area. Providence concluded that development of Helvick on a stand-alone basis could not be justified given market conditions at that time. However, recent modern analysis of well test data suggests that wells could produce oil at significant rates under primary depletion. This, together with improved commodity prices, indicates that Helvick could provide the potential for a small field development. Accordingly, the Company is looking at a number of low cost development options for the field and in 2010, agreed to assign a 10% non-operated interest in the field to Lansdowne Oil and Gas plc.

Partners in the project include, Lansdowne Oil and Gas Plc, Atlantic Petroleum and Sosina Exploration.

ARDMORE / NEMO (54.4%, Operator)

The Ardmore gas field lies approximately 48 km north-east of the Kinsale Head gas field. The discovery well, 49/14-1, was drilled in 1975 by the then Operator, Marathon, and flowed at an aggregate rate of circa 8 MMSCFGD. In 2006, Providence completed a high-resolution pseudo-3D seismic survey over the field. A recent assessment of these data, together with a re-evaluation of the original well test data, indicates a recoverable reserve potential of c. 30 BSCF within the uppermost reservoir interval.

In addition, deeper oil reservoir intervals termed Nemo are thought to contain up to 230 MMBO of heavy 16° API oil. In 2010, the partners agreed a two step farm out in the block to Nautical Petroleum, a UK heavy oil specialist, which involves Nautical funding and carrying out a focused work programme on the development feasibility of the Nemo oil discovery in return for 25% equity in the field. Nautical has an option to increase its stake in the field to 65% and take-over operatorship should it elect to drill an appraisal well on Nemo by the end of 2011 should they elect to drill an appraisal well by end of 2011.

Partners in the project include Nautical Petroleum, Atlantic Petroleum and Sosina Exploration.

TGS Stand

TGS provides multi-client geoscience data and services to oil and gas Exploration and Production companies around the globe. TGS' geophysical and geological data products include multi-client seismic libraries, extensive magnetic and gravity data, the industry's largest global database of digital well logs and regional interpretive products. TGS also provides high-end depth imaging services to help resolve complex seismic imaging problems.

Geophysical

- 2D & 3D Seismic
- Depth imaging products
- Wide Azimuth Seismic
- Aeromagnetics
- Gravity
- Electromag (CSEM)
- Multi-beam

Geological

- Digital well data
- Directional surveys
- Production data
- Core data
- Regional geologic
- Interpretations
- Facies Map Browser
- Interpretive Services

Imaging

- Seismic processing
- High end depth imaging
- Proprietary technology
- Ongoing R&D investment
- Contract business model

TGS specializes in planning, acquiring and processing multi-client geophysical data in major and emerging offshore exploration plays worldwide. Resources are centred on a core collection of multi-client exploration data products. These data sets are diverse in location, acquisition technique and specifications and are united by a common approach to quality assurance, advanced processing and expertise. TGS' 2D and 3D seismic library is among the strongest, most diverse and highest quality in the marketplace. The company also offers value-added

gravity and magnetic data products to complement regional interpretations and seismic data packages.

TGS has a large geophysical database in Ireland including:

- Over 20,000 km of multi-client seismic data
- Facies Map Browser
- Seep data

These data provide the exploration tools for evaluating open acreage. Examples from the TGS' long offset database are on display in the booth.

Western-GECO Stand

WesternGeco provides comprehensive worldwide reservoir imaging, monitoring, and development services. We operate the most extensive range of seismic crews and data processing centres in the industry, as well as holding the largest multiclient seismic library. The unsurpassed array and distribution of WesternGeco resources is ready to meet any geophysical challenge. Our GeoSolutions group applies advanced seismic technologies to better understand the reservoir—to serve not only explorationists, but also reservoir and petroleum engineers, appraisal and production teams.

Marine Acquisition

Plotting a course for exploration and production success

[Q-Marine](#) | [Wide-Azimuth](#) | [Coil Shooting](#) | [Dual Coil Shooting](#) | [DISCover](#) | [CLA — Continuous Line Acquisition](#) | [4D Seismic Technology](#) | [Q-Seabed](#) | [Multicomponent Seismic Technology](#)

Land and TZ Acquisition

Global imaging experience, advanced proprietary technology

[Worldwide Services](#) | [Q-Technology for Land](#) | [Land Electromagnetics](#)

WesternGeco GeoSolutions

WesternGeco GeoSolutions brings together the people, the tools, and the technology to enable our clients to capture the benefits of a comprehensive and integrated suite of seismic processing and imaging services. In our worldwide processing centres, in client offices, and on our acquisition crews, WesternGeco specialists provide the industry's most advanced processing solutions.

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Data Processing and Imaging

Differentiated technologies, industry-leading applications

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Multiclient Data Library

High-quality seismic data for the world's most prospective hydrocarbon basins.

POSTER ABSTRACTS (in alphabetical order)

The Jurassic-Cretaceous transition in the northeastern part of the Porcupine Basin, offshore Ireland

Bulois, C.¹; Shannon, P.M.²

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In the northeastern Porcupine Basin, the transition from an Upper Jurassic syn-rift system to a post-rift subsiding basin in the Cretaceous is often interpreted as a sharp unconformity running close to the base of the Cretaceous succession. The so-called Base Cretaceous Unconformity represents an important phase of uplift sealed by the deposition of Neocomian and Aptian/Albian sediments. However, the uplift amount and the depositional mechanism(s) remain unclear as the Early Cretaceous succession is only locally and patchily preserved in wells. Moreover, the basin architecture and geometry and age of strata are still poorly constrained in many places.

The re-evaluation of regional wells, together with 2D and 3D seismic data, suggests that rifting phase commenced in Late Jurassic time continued during most of the Neocomian. Several unconformities, disconformities and depocentres developed during that period. They resulted from an irregular early topography, base level changes and fault reactivation phases. At least two main extensional pulses, coeval with the formation of the Base Cretaceous and Top Neocomian unconformities, are identified bounding a syn- to post-rift transitional succession. In addition, spectacular fault-scarp degradation events and the construction of meandering channels and deeper water turbidite-like sedimentary systems are recognised.

This project is part of a PhD research funded by the Irish Petroleum Infrastructure Programme.

Modelling the thermal structure of onshore Ireland and its offshore basins

Chew, D.M.; Döpke, D.¹;

Department of Geology, School of Natural Science, Trinity College Dublin, Dublin 2, Ireland.

Our knowledge of the thermal structure of the Irish crust and lithosphere is still very incomplete (Goodman et al., 2004, Sustainable Energy Ireland report). This project will characterize and model the thermal evolution of the Irish mainland and its offshore basins. Goals of the project include identifying regions of high heat flow (onshore) with implications for geothermal target assessment, and establishing the timing of basin inversion (offshore) with implications for petroleum exploration.

This project will involve collection of rock samples for thermal history analysis followed by thermal history modelling. Onshore sampling of steep escarpments will allow near-vertical thermal-history profiles to be developed, which will be reinforced with data from deep boreholes provided by the Geological Survey of Ireland (GSI). Offshore sampling will utilize

existing petroleum exploration boreholes where material is accessible. Apatite fission track analysis will be undertaken in the fission-track laboratory in Trinity College Dublin while organic maturation studies (vitrinite reflectance) will be undertaken in conjunction with Prof. Geoffrey Clayton. (U-Th)/He apatite dating (which will represent the first regional study in Ireland using this low-temperature thermochronometer) will be undertaken in collaboration with Dr Finlay Stuart (Scottish Universities Environmental Research Centre).

Combined, these data will constrain the thermal history of a package of rocks from 120°C to 40°C, where temperature is a function of depth (the geothermal gradient) in the upper 0.5 - 3 km of the crust. The thermal history data will then be modelled to yield 2D and 3D temperature history models and integrated with the GSI 3D visualization suite. Low-temperature thermal history analysis is also ideally suited to studying the development of sedimentary basins as the 120°C to 40°C temperature range contains the hydrocarbon maturation window. Knowledge of the thermal history has important implications for the prospectivity of petroleum systems including trap breaching and the probability of encountering effective top-seals; the timing of source maturation and the quality of reservoir rocks due to higher levels of reservoir diagenesis.

Inorganic analysis of sediment samples taken from Dunmanus Bay, Ireland

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¹Chemical & Environmental Sciences Dept., University of Limerick

²Chemical Sciences, Dublin City University

AQUAFAC International Services Ltd. and Dublin City University (DCU) were grant aided by INFOMAR to carry out a ground-truthing survey of pockmark areas in Dunmanus Bay, Co. Cork. During a sampling expedition in April 2009 a range of sea bed samples were taken including gravity cores, box cores and day grab samples. In all, 132 sampling stations and 12 gravity core stations were identified and sampled. A multidisciplinary approach is now being taken to gain an insight into the nature of the seabed in the area within and without the pockmarks. This involves geophysical (GSI), biological (Aquafact), geochemical (DCU, TCD and UL) and microbiological (Queens University Belfast) investigations. Specifically, the UL contribution includes analysis and characterisation of the inorganic components of the sediment core and grab samples taken from within and outside pockmark areas of Dunmanus Bay. Analytical techniques including X-ray Diffraction (XRD), X-ray Fluorescence (XRF) and Scanning Electron Microscopy (SEM/EDAX) are being employed to assess the geochemical properties of sediment in the bay. After characterisation, the source and possible influence on natural processes such as hydrocarbon formation and seepage from surrounding rivers and agricultural landscapes will be assessed. Initial work, to date, has focussed on analysis of day-grab samples and gravity core samples gathered from the bay. Day-grab samples are gathered from the surface of the seabed, while gravity core samples penetrate one metre into the seabed. Exact co-ordinates were taken for each sample location. Samples have been analysed for elemental content using X-ray Fluorescence (XRF). Sample preparation for this analysis involves a series of drying and sieving techniques. Early results, for samples taken from various sampling stations confirm elemental abundances for calcium, titanium, iron, zinc and bromine. It is envisaged that when complete, the analysis results will provide a detailed and comprehensive summary of elemental concentrations throughout the bay.

A 3D crustal-scale, geological model of the North of Ireland – V1

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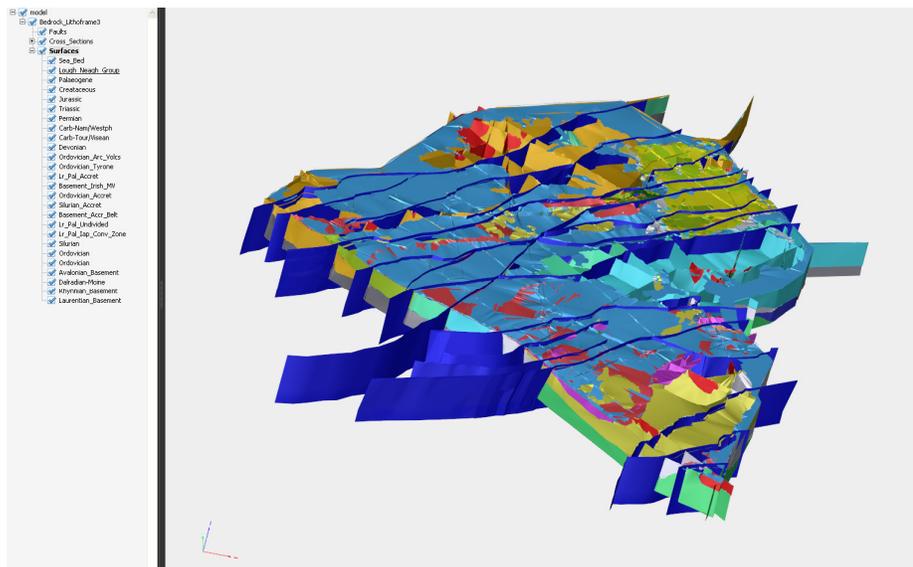
(2) British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH9 3LA

(3) Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4

(4) British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH9 3LA

(5) British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG

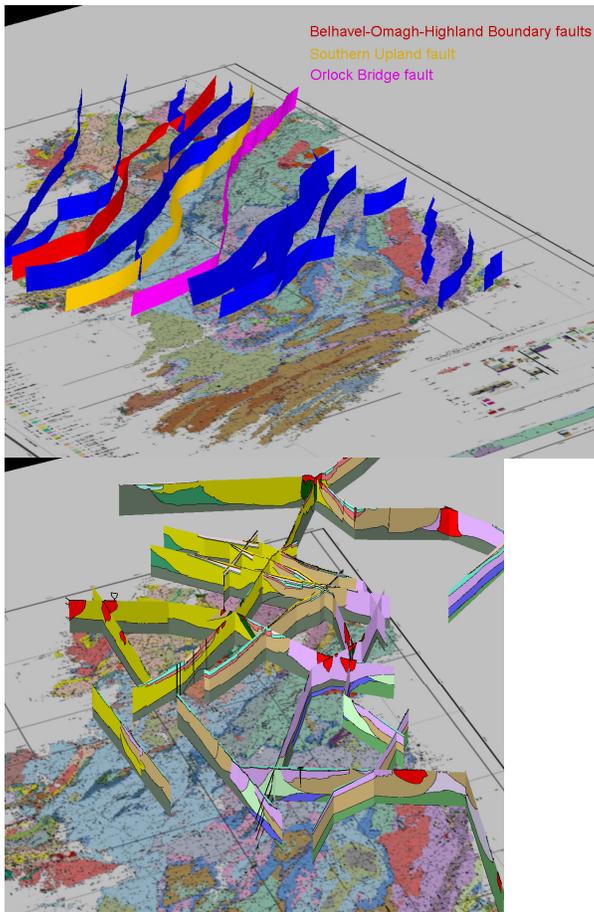
This Geological Survey of Northern Ireland (GSNI), British Geological Survey (BGS) & Geological Survey of Ireland (GSI) collaboration is driving the construction of a regional-scale model of the fundamental architecture of the upper crust (top 15 km) of Britain and Ireland at a nominal scale of 1:500 000 (see below).



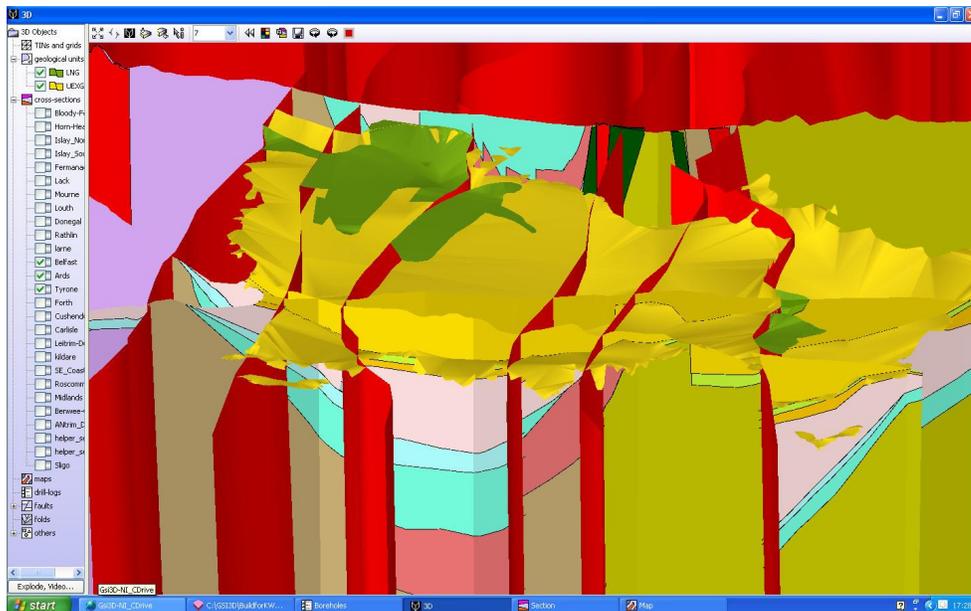
The aim is to provide a model that can be used as a dynamic context for the widest possible range of larger-scale models relevant to government, industry, research and education. We are constructing this model within the BGS GSI3D package but it is interoperable with other modelling packages such as GOCAD® and GeoVisionary.

The model is constructed around a framework of deep geological cross-sections and faults (see below) that capture published geological mapping and 3D interpretation, integrated with the interpreted results of regional geophysical potential field and seismic survey.

ATLANTIC IRELAND 2011



The faults and sections are integrated with outcrop/subcrop maps of the intervals to be modelled, and it is from these that basal surfaces of the potential volumes are calculated (see below).



We aim ultimately to have a volume-attributed model which can host site/topic specific models at a variety of scales. Our 'Test Block' started with Northern Ireland (GSNI Tellus2

funded) and the northern half of the Republic of Ireland (GSI). Continued development has seen the model expand across all of Scotland and northern England through the work of the BGS. The remainder of Britain and Ireland will be incorporated in due course, and as the project continues we will seek input from academia and industry via a user portal. Model development across offshore continental shelf areas, including the Irish Shelf, is intended, but will require financial backing from interested stakeholders.

Did North Atlantic Igneous Province igneous sills trigger or maintain Paleocene Eocene Thermal Maximum global warming?

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² *School of Geography, Earth and Environmental Sciences, University of Birmingham, UK*

³ *School of Geosciences, University of Aberdeen, UK*

North Atlantic Igneous Province (NAIP) sills intruding organic-rich sediments generated greenhouse gases by thermal maturation. Hydrothermal vents above sills allowed such gases to escape to the ocean and atmosphere. It has been suggested that NAIP sill-generated gas forced warming during the Paleocene Eocene Thermal Maximum (PETM). As the atmospheric residency time of methane was approximately one decade during the Paleocene, the triggering methane pulse would require on the order of 100 Gt or more of carbon to be released within a period of ~10 years or less. Recent field observations of fluidized country rocks around sills are used here to speculate on a new model for sill emplacement, greenhouse gas generation and escape. This model implies that the rapidly released gases which initially escaped up the hydrothermal conduit were supplied from a region surrounding the sill rim, rather than the strata above and below the sill that correspond to its thermal aureole. The gas produced in the rest of the aureole would have seeped up the conduit over a much longer period, closer to a century in duration. The prevalence of mound-, rather than crater-topped, hydrothermal vents is consistent with this interpretation. NAIP sills are therefore unlikely to have delivered a sufficiently large gas volume swiftly enough to have triggered the PETM. The sill-generated gas is more likely to have helped maintain warming after it was initiated.

This project is funded by the Irish Petroleum Infrastructure Programme (PIP).

North Atlantic Igneous Province sills, offshore western Ireland: Location, distribution and characteristics

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¹*Department of Geology, School of Natural Sciences, Trinity College Dublin, Ireland*

²*School of Geography, Earth and Environmental Sciences, University of Birmingham, UK*

2D and 3D seismic data has been used to map 287 saucer-shaped sills in the Hatton, Slyne-Erris, NE Rockall and Porcupine basins, offshore western Ireland. Given the size and distribution of the sills, and seismic data coverage, over 900 intrusions may be expected in the Irish sector of the North Atlantic Igneous Province (NAIP) and more than 5,800 may be present in the entire NAIP. The intrusions are not randomly distributed, rather they occur in clusters. The number of sills per km increases both westward and northward. This is unsurprising as the rift zone and the centre of the plume head thought to be responsible for magma generation are located northwest of the Irish sector. Also, the westernmost basin of Hatton was actively rifting at the time of sill intrusion, while rifting had ceased in the eastern basins. Sills are concentrated at present-day depths of 2–4 and 7–11 km, with most sills located below the Cretaceous chalk. The majority of sills are thought to have intruded at depths of 1.5–2.5 km. Sill lateral extent ranges from 0.25–29 km, with an average of 3.5 km. Sill thickness ranges from ~50–300 m, with an average of 134 m. Sill area was calculated at 3.2×10^5 and 3.12×10^6 km² for the Irish sector and total NAIP, respectively. Sill volume ranges from 1.6×10^7 – 9.6×10^7 km³ and 1.56×10^8 – 9.36×10^8 km³ for the Irish sector and total NAIP, respectively.

This project is funded by the Irish Petroleum Infrastructure Programme (PIP).

Processing and acquisition design through elastic simulation: A North Sea case study

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⁽²⁾ *Panorama Technologies, 14811 St. Marys Lane, Houston, TX 77079, USA*

It is quite common for mature North Sea fields to be producing significant volumes but infill drilling may be using maps made on survey data which is over a decade old. New acquisition has been common where the reservoirs are acoustically favourable to time-lapse (4D) studies but in many fields new acquisition is often thought to be unjustifiable based on cost and a perceived stagnation in the continued improvement in acquisition quality. New understanding of the value of azimuthally diverse information has undoubtedly brought a step change in image quality to sub-salt reservoir delineation. In this paper we use 3D elastic modelling to try and decide whether different acquisition geometries may bring similar benefits to North Sea imaging and multiple suppression.

The third Central & North Atlantic Conjugate margins conference, Trinity College, Dublin, 22-24 August 2012

Hickey, E.

Conference Partners Team, Dublin. elva@conferencepartners.ie

Introduction

The Third Central & North Atlantic Conjugate Margins Conference will take place in Trinity College, Dublin from Wednesday 22nd to Friday 24th August 2012.

This conference follows the successful inaugural Central Atlantic Conjugate Margins Conference in Halifax, Canada in 2008 and the Second Central & North Atlantic Conjugate Margins Conference in Lisbon, Portugal in 2010. Dublin 2012 is designed to attract and bring together representatives of industry, academia, and others interested in the relationships between margin evolution and petroleum systems, particularly those currently interested in exploring and working in the Central and North Atlantic and adjacent basins. We believe that the regional focus of the event coupled with access to modern seismic data and new ideas will be a catalyst for a better understanding of the prospectivity of the region.

Trinity College, Dublin is a beautiful historic university that is centrally located in the heart of Dublin city. The geology department in Trinity College is one of the oldest geology departments in the world with the Chair of Geology and Mineralogy being established in 1843.

Thematic Sessions

Atlantic Margin Evolution & Development

The goal of the session is to foster new insights about the structure and development of all the Atlantic margins, especially those of the North and Central Atlantic. We invite submissions that involve numerical and/or analogue modelling, seismic imaging and interpretation that is focused on passive margin development controls, case studies from the North or Central Atlantic margins or relevant global analogues. Possible topics include:

- Processes that control rifting and break-up, from distributed extension to the rift-to-drift transition
- Margin segmentation by transform faulting and other mechanisms
- Uplift and subsidence history, sedimentation, and plate tectonic reconstructions
- Distribution and timing of magmatism
- Evolution of evaporite basins
- Synrift to post-rift depositional systems

Plate Reconstruction of the Atlantic Ocean

The goal of this session is to foster new insights into the advances in Plate Reconstruction techniques and their importance in the understanding of the development of the Atlantic Ocean, especially the North Atlantic and Central Atlantic segments extending into the Arctic Ocean. We invite submissions that involve numerical and/or analogue modelling, geophysical data constraints, or those that represent case studies from the Atlantic margins or relevant global analogues. Possible topics include:

- New plate models including new kinematic models
- Poles of Rotation – new data and insights on old data

- Continent-Ocean Boundaries (COB) definition and its role in improving plate models
- Backstripping and stretching factors
- New gravity and magnetic models of Atlantic margins and their relevance to plate modelling

Atlantic Basin Petroleum Systems

Papers and posters submitted for this session should address parameters used in assessing petroleum systems including proven systems and current hydrocarbon production with emphasis on basins of the Central and North Atlantic conjugate margins. Possible topics include:

- Role of salt tectonics in heat flow and petroleum systems development
- Imaging, provenance, transport, and distribution of deep-water reservoir sands
- Heat flow in relation to various phases of rift/drift transition
- Reservoir/seal analysis
- Overpressure
- Documenting deepwater erosional unconformities, palaeo-temperature and palaeo-water depth
- Influence of late-phase slow rifting and subsequent drifting on hydrocarbon generation and expulsion
- 3D and 4D basin model simulation
- Influence of drift phase compressive events on petroleum systems
- Volcanic events and their influence on thermal maturity of source rocks
- Source rock development, organic facies and anoxic events
- Source rock kinetics and timing of hydrocarbon generation and expulsion

Atlantic Margins E&P

This session will examine geological and geophysical analogues of hydrocarbon discoveries and producing fields within the Atlantic petroleum environment. Comparisons and reviews of existing petroleum fields on both sides of the Atlantic are welcome with particular attention to the exploration reasoning that led to these discoveries. We would also invite submissions that focus on newer exploration technologies such as seismic

imaging and amplitude analysis, electromagnetic detection of hydrocarbons and other techniques to reduce exploratory risk. Other possible topics include:

- Source rock
- Reservoir petrology
- Overpressure
- Stratigraphic studies (e.g. sequence stratigraphy, biostratigraphy, chemostratigraphy)
- Depositional models
- Core studies

Offshore resource opportunity 2011 calls for bids

Kendell, B.

Department of Natural Resources, Canada



Offshore Resource Opportunity 2011 Calls for Bids



Hibernia Platform - photo courtesy of HMDC

Newfoundland and Labrador

Canada's offshore oil producing region - 1.2 billion barrels of oil produced

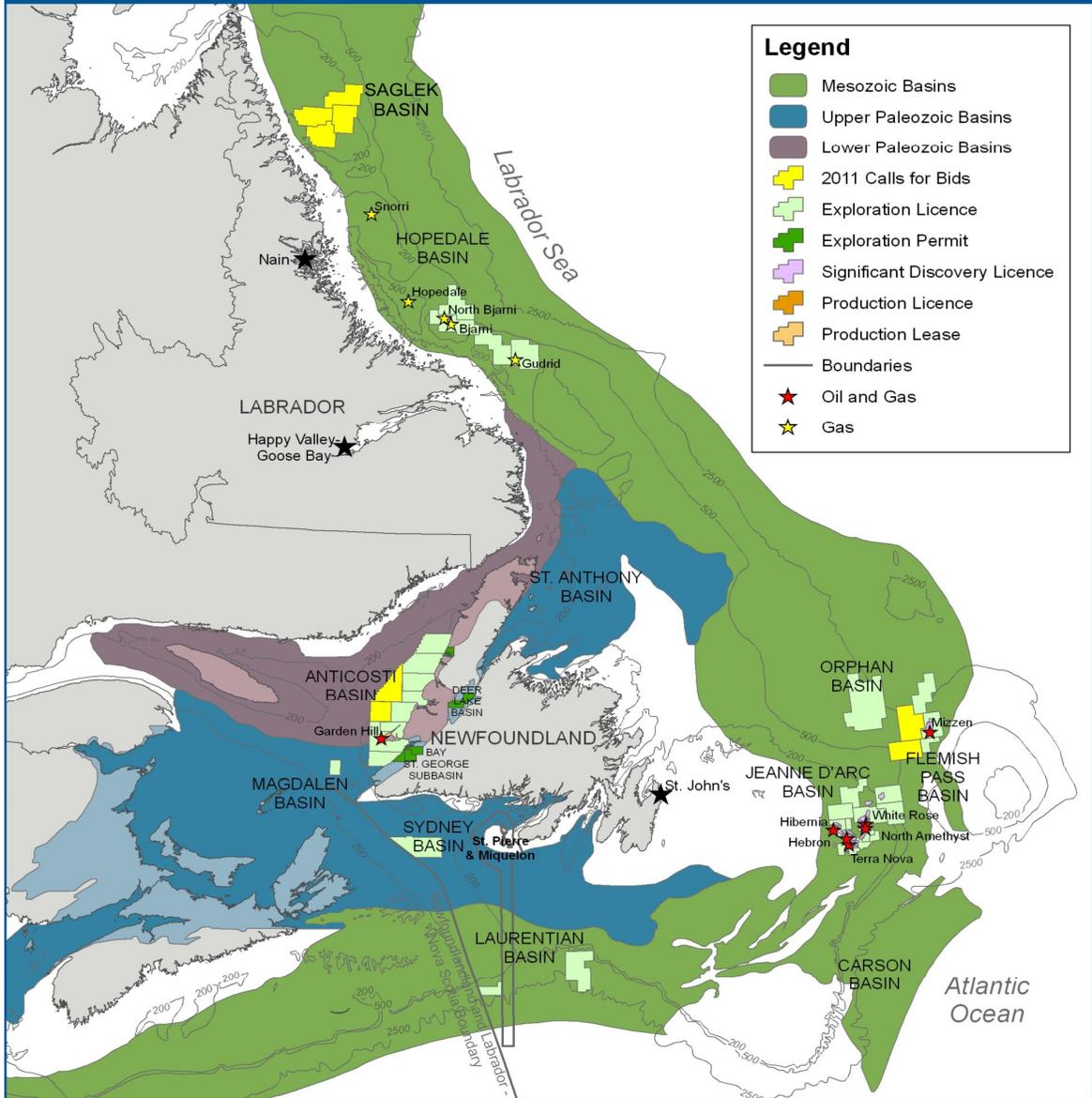
- ✓ The 2011 Calls for Bids offers eight large parcels totaling 1,891,782 hectares (4,674,695 acres) in three diverse areas
 - Western Newfoundland Offshore Region - Anticosti Basin
 - Eastern Newfoundland Offshore Region - Flemish Pass/North Central Ridge
 - Labrador Offshore Region - Saglek Basin
- ✓ Excellent prospectivity in proven and frontier regions
- ✓ Competitive fiscal regime with low political risk
- ✓ Deadline for submission - November 15, 2011

For more information: www.cnlopb.nl.ca/news/nr20110512.shtm



Newfoundland
Labrador
Natural Resources
it's happening here.

Newfoundland and Labrador Basin Map



Department of Natural Resources
www.gov.nl.ca/nr



Extension of onshore bedrock geology to the offshore based on existing INFOMAR data: an investigation of potential approaches and methodologies

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² Department of Geology, University College Cork, p.meere@ucc.ie

Dr. Max Kozachenko (Marine Geologist, CMRC, UCC) and Dr. Pat Meere (Lecturer in Geology, Dept. of Geology, UCC) have recently completed a project funded by the INFOMAR programme (<http://infomar.ie>) aiming at investigation of potential approaches and methodologies for extension of Ireland's onshore bedrock geology to the offshore based on existing INFOMAR seabed mapping data. South-western coast of Ireland was chosen as a broad study area due to availability of good quality offshore data and sound knowledge of the onshore bedrock geology. The project evaluated large quantity of data, including multibeam bathymetry, LIDAR, seismic, as well as conducted extensive coastal fieldwork and evaluated existing terrestrial bedrock geology maps, aerial and satellite imagery. Although the marine study areas chosen contained extensive areas of outcropping rocks with clearly expressed bedding and fracture patterns imaged on high resolution multibeam mapping – this work still revealed the full complexity of performing geological mapping in the offshore environment. The main challenge being that it is not possible to directly measure the geological features and conclusions have to be drawn from interpretation of remotely sensed data, hence, being limited by resolution of the data. This project produced bedrock geology maps of area of seabed located east of the Old Head of Kinsale and of the Bantry & Dunmanus Bays, Co. Cork, and what is most important developed and tested methodologies for mapping of bedrock geology in the offshore context that can be applied to mapping larger areas of seabed in the future.

Recommendations regarding additional investigations aimed at improving offshore bedrock geology mapping produced by this project (listed from low to high cost):

- Seismic profiles oriented perpendicular to the regional strike obtained with technique capable penetrating in rock to show the dip of geological layers and fractures to allow better correlation with the onshore mapping.
- Surface rock samples from offshore rock outcrops.
- Offshore cores through rock outcrops, which will allow detailed correlation with bedrock geology exposed in the onshore outcrops and onshore boreholes. This is a costly operation involving rock drilling in the offshore conditions.

Overall Recommendations:

It is very evident that the coming years will see the acquisition of significant high resolution bathymetric data coverage for the Irish offshore. If these data are to be put to optimum use it will require, relative to the cost of data acquisition, relatively modest investment by our national government and/or industry in research that will lever these data in a manner that produces the best possible cartographic outputs that link the offshore to the onshore geology of Ireland.

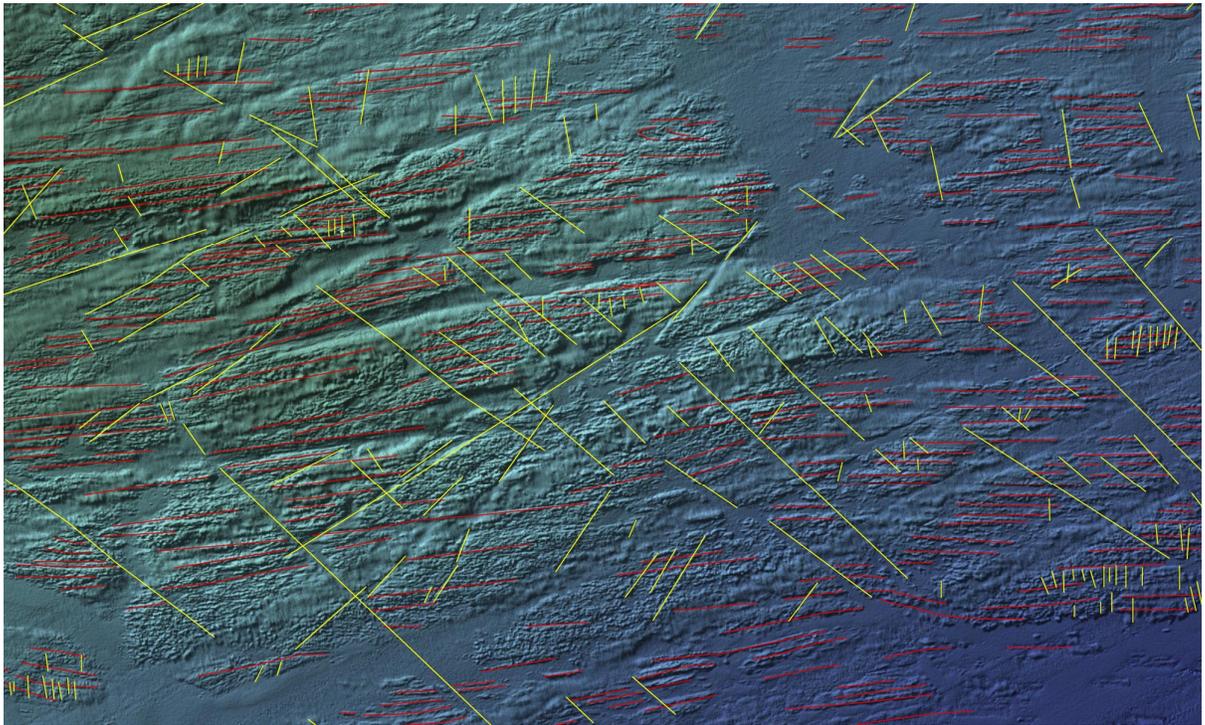


Figure: Multibeam data showing seabed rock outcrops near the Old Head of Kinsale with superimposed interpretation of the geological lineaments including bedding (red lines) and fractures (yellow lines)

Ireland Array: Broadband seismic investigation of the lithospheric structure and evolution of Ireland and surroundings

Lebedev, S.; Readman, P.; Horan, C.; Schaeffer, A.; Collins, L.; Hauser, F.; O'Reilly, B.; Blake, T.

DIAS

Ireland Array, a new array of broadband seismic stations, is being deployed across Ireland. Ireland Array is a seismic antenna the size of the island, aimed deep down into the Earth. It records vibrations of the Earth's surface caused by distant and nearby earthquakes, as well as by ocean waves near Ireland's shores.

Ireland Array's backbone component comprises 20 very-broad-band stations, deployed for 5 years. An additional, mobile component is used for shorter installations, zooming in on detailed local structure. The new data will reveal the structure of the crust and mantle beneath Ireland in unprecedented detail. The main targets of this project are the seismic-velocity and thermal structure of the crust and lithosphere. Seismic anisotropy will yield information on past and present deformation of the lithospheric plate and underlying mantle. The results will provide new insight into the evolution of Ireland and the North Atlantic, including basin development.

Extreme crustal extension and mantle serpentinisation at the Porcupine Arch – New estimates of crustal stretching

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The Porcupine Basin is well known to have undergone significant extensional strain during formation, with strain – estimated from subsidence analysis – increasing both across and down the axis of the basin. More recent estimates of crustal stretching (β_C) far in excess of those derived from subsidence analysis have been suggested from geophysical investigations over the region of the Porcupine Arch (RAPIDS4 & PIMS4 wide-angle experiments, as well as gravity modelling). These investigations demonstrate a major reduction in crustal thickness toward the centre of the basin, thinning to 2-3km thickness - corresponding to $\beta_C \geq 10$. The presence of a serpentinite undercrust has also been identified beneath the Arch based on velocity and gravity anomalies.

We present crustal scale interpretations of a suite of PSDM 2D reflection seismic data covering the region of the Porcupine Arch. Included here are selected lines from ION-GXT's recently acquired, long-offset, deep penetration, IR1 survey, gathered as part of their NE Atlantic SPANS™ program, and selected lines from the SPB97 survey. Crustal thicknesses were measured for these interpreted data, and contours of crustal stretching constructed. The resulting contours demonstrate good agreement to the seismically (refraction) and gravity derived crustal thicknesses for the Porcupine Arch, but are in disagreement with the subsidence derived stretching contours.

We observe that once $\beta_C \approx 2-3$ is achieved, it rapidly approaches infinity (crustal separation and mantle exhumation). We propose that this may result from the onset of mantle serpentinisation following total crustal embrittlement. Serpentinite can appear isostatically and geophysically similar to crustal material. Reduction in post-rift subsidence due to serpentinisation may - at least partially - explain the far greater amount of crustal stretching than may be implied from subsidence estimates.

Multidisciplinary characterisation of methane seepage features in Irish waters

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¹Dublin City University, Dublin 9, Dublin, Ireland,

²Queen's University Belfast, Belfast, Antrim, N. Ireland,

³Geological Survey of Ireland, Dublin 4, Dublin, Ireland.

Introduction

Vast amounts of methane (CH₄) are stored and produced in the oceans seafloor^[1], in particular as sites of active CH₄ seepage and seabed seepage is a significant component of the global carbon cycle. In addition seepage facilitates the formation of dramatic geological features on the oceans seafloor, supports unique biodiversity, and commercially are sites of potentially vast energy resources. Most produced CH₄ is consumed by microbial processes in the water column or by anaerobic oxidation of methane (AOM)^[2]. However the formation, physical and geochemical processes, and biological composition of these methane seepage settings are poorly understood. In Irish waters, seabed fluid flow features known as pockmarks, mud diapirs and methane-derived authigenic carbonate (MDAC) mounds have been documented^{[3][4][5][6]}. This project aims to characterise these features by a multidisciplinary geophysical, molecular biological and geochemical approach.

Methods

Sampling locations included pockmarks (Irish Sea, Dunmanus Bay and Malin Sea); a mud diapir (Lambay Deep, Irish Sea); and an MDAC mound site (Codling Fault Zone (CFZ), Irish Sea). Features were investigated by underwater video, multibeam bathymetry and sub bottom seismic profiling in conjunction with geochemical pore water, gas and organic geochemical analysis and a number of microbial ecology approaches.

Results

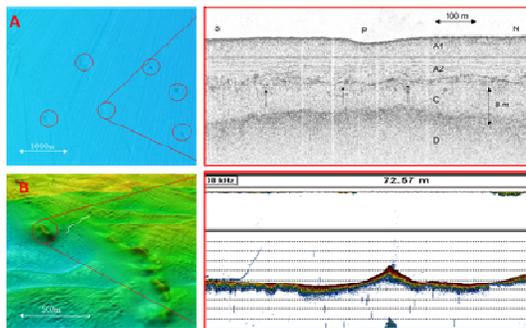


Fig. 1. Seabed and sub-bottom seismic mapping of (A) Irish Sea mudbelt pockmarks suggesting no gas seepage (B) Codling Fault MDAC mounds with active seepage from one of the mounds.

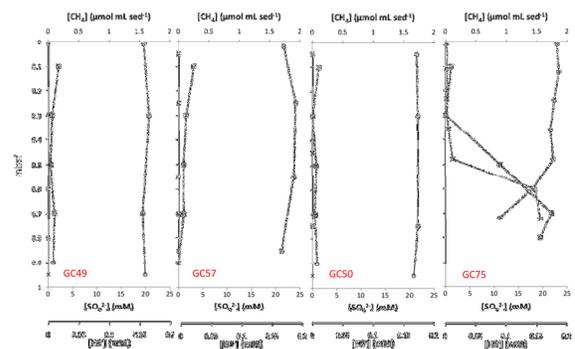


Figure 2: CH₄, SO₄²⁻ and HS⁻ downcore profiles of an Irish Sea pockmark (GC50) compared with control cores GC49 and GC57. GC75 is a positive control

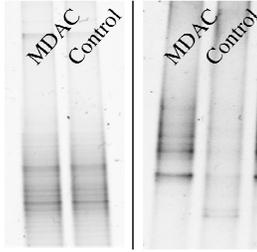


Figure 3: Bacterial (left) and archaeal (right) denaturing gradient gel electrophoresis community profiles of Codling Fault MDAC and control sample

Discussion and Conclusion

Negligible sulfate depletion (SO_4^{2-}) and low methane (CH_4) and sulphide (HS^-) levels (Fig. 2), in conjunction with absence of water column and subsurface gas indicators (Fig. 1A) and underwater video investigations indicate that studied Irish sea pockmarks and the Lambay Deep mud diapir are not influenced by active gas seepage and are possible dormant features at present. Lipid biomarker composition and $\delta^{13}\text{C}$ values ($\sim -31\text{‰}$ characteristic of higher plants) indicate major organic matter input from terrestrial sources and not from CH_4 seepage (data not shown).

Seismic profiling shows active seepage from one of the Codling Fault Zone (CFZ) mounds (Fig. 2B) and under water video investigations and seabed sampling around the CFZ region confirm the presence of slabs and pavements as part of the mound structure, the presence of numerous carbonate nodules and concretions, black anoxic seabed and significant cemented worm tubes (data not shown) indicate AOM is occurring. Denaturing gradient gel electrophoresis (DGGE) profiles of sampled MDAC (Fig. 3) shows that there is a distinct archaeal community at the CFZ site and likely linked to anaerobic oxidation of methane (AOM). However the bacterial community profile is highly similar to surrounding seabed. Lipid biomarkers show significantly greater abundance of bacterial biomarkers compared to the control (data not shown) indicating enhanced bacterial activity at the mound site.

DGGE profiles of the Malin Pockmark show the presence of uncultured archaea closely related to those found in active seepage environments (deep sea mud volcanoes, CH_4 hydrate-bearing sediments) indicating the pockmark is or has been an active seepage site. The Malin pockmark bacterial community is dominated by γ - and α -proteobacteria related to *Psychrobacter* and *Sulfitobacter* sp. respectively. Uncultured bacteria found in CH_4 hydrate-bearing sediments and those related to the hydrocarbon-degrading bacteria *Alcanivorax borkumensis* were also found to be significant (data not shown).

Current findings highlight the widespread occurrence of seepage environments in Irish waters, the complex processes at these sites and also the potential implications for Irish climate in the future. The potential for commercial exploitation of seeping gas and possible associated hydrocarbons at these sites is emphasized.

Geo-Seas – building a unified marine geoscientific data infrastructure for Europe

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A significant barrier to marine geoscientific research in Europe is the lack of standardised marine geological and geophysical data and data products which could potentially facilitate multidisciplinary marine research extending across national and international boundaries. Although there are large volumes of geological and geophysical data available for the marine environment it is currently very difficult to use these datasets in an integrated way due to different nomenclatures, formats, scales and coordinate systems being used within different organisations as well as between countries. This makes the direct use of primary data very difficult and also hampers use of the data to produce integrated multidisciplinary data products and services.

Marine geological and geophysical data includes raw observational and analytical data acquired from seabed sediment samples, boreholes, geophysical surveys (seismic, gravity etc), multibeam and sidescan sonar surveys as well as derived data products such as seafloor maps. All of these data types are required in order to produce a complete interpretation of seafloor geology, an essential component of integrated multidisciplinary ocean science.

The overall objective of Geo-Seas, a EU Framework 7 funded project, is to build and deploy a unified e-infrastructure which will facilitate the sharing of harmonised marine geoscientific data within Europe. This will result in a major improvement for researchers, stake holders and policy makers wanting to identify, locate and access marine geological and geophysical data and data products held by national geological surveys and research institutes across Europe.

Geo-Seas is building on the work already done by the existing SeaDataNet project which currently provides a data management e-infrastructure for oceanographic data which allows users to locate and access federated oceanographic data sets. By adopting and adapting the SeaDataNet methodologies and technologies the Geo-Seas project will not only avoid unnecessary duplication of effort by reusing existing and proven technologies but will also facilitate multidisciplinary ocean science across Europe through the creation of a joint infrastructure for both marine geoscientific and oceanographic data.

This approach will also lead to the development of collaborative links with other European projects including EMODNET, Eurofleets and Genesi DEC as well as extending to the wider marine geoscientific and oceanographic community including projects in the USA such as the Rolling Deck Repository (R2R) initiative and also organisations in both the USA and Australia.

The key outcome of the Geo-Seas project will be the provision of on-line access to discovery metadata as well the associated federated data sets via a dedicated Geo-Seas portal. This will allow the end users to locate, assess and access standardised geoscientific data from multiple sources which is also interoperable with other marine data types which will in turn facilitate the multidisciplinary use of geoscientific data in combination with other data types.

Seismic Imaging of variable water layer sound structure in the Rockall Trough, NE Atlantic

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Natural variation in sound speed within ocean water can degrade sub-seabed images from 2D, 3D and 4D seismic reflection datasets. Degrading effects include vertical offset of reflections between adjacent or intersecting sail lines, and difficulties in suppressing multiples from water layer reverberations. Rockall Trough, offshore Ireland, is a natural laboratory to investigate water layer variability in water depths ranging from 200 m to 3.5 km. A compilation of vertical sound speed profiles, calculated from temperature and salinity profiles obtained by probes lowered from ships, shows that the mean sound speed in the water layer mostly varies between 1490 and 1500 m/s. Vertical offsets of up to at least 15 ms two-way travel time at line intersections are predicted. A significant amount of the total observed sound speed variability can occur along a single seismic sail line. These effects result mainly from spatial and temporal fluctuations in the thicknesses of, and vertical sound speed gradients within, an upper layer of North Atlantic Central Water and a mid-depth layer of Mediterranean Outflow Water. Seismic sections across Rockall Trough show strong lateral variability in reflectivity within these same two water layers. Some reflective packages contain lens-shaped structures consisting of reflective rims and transparent cores and with diameters between 10 and 50 km. Other reflective packages have abrupt, almost vertical boundaries and no distinct transparent core. The lateral boundaries of the reflective packages are likely to be associated with significant variations in average water layer sound speed.

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