

Recent Atlantic Margin exploration drilling confirms Lower Cretaceous carbonate exploration play in the southern Porcupine Basin, offshore Ireland

John O'Sullivan, Stephen Jones, Rob Hardy & Dave Chew

AAPG Europe Regional Conference
Global Analogues for the Atlantic Margins
Lisbon, 2-3 May 2018

Agenda

- Introduction
- Regional Setting
- Pre-Drill Prognosis
- Well Results
- Post Well Studies
- Summary

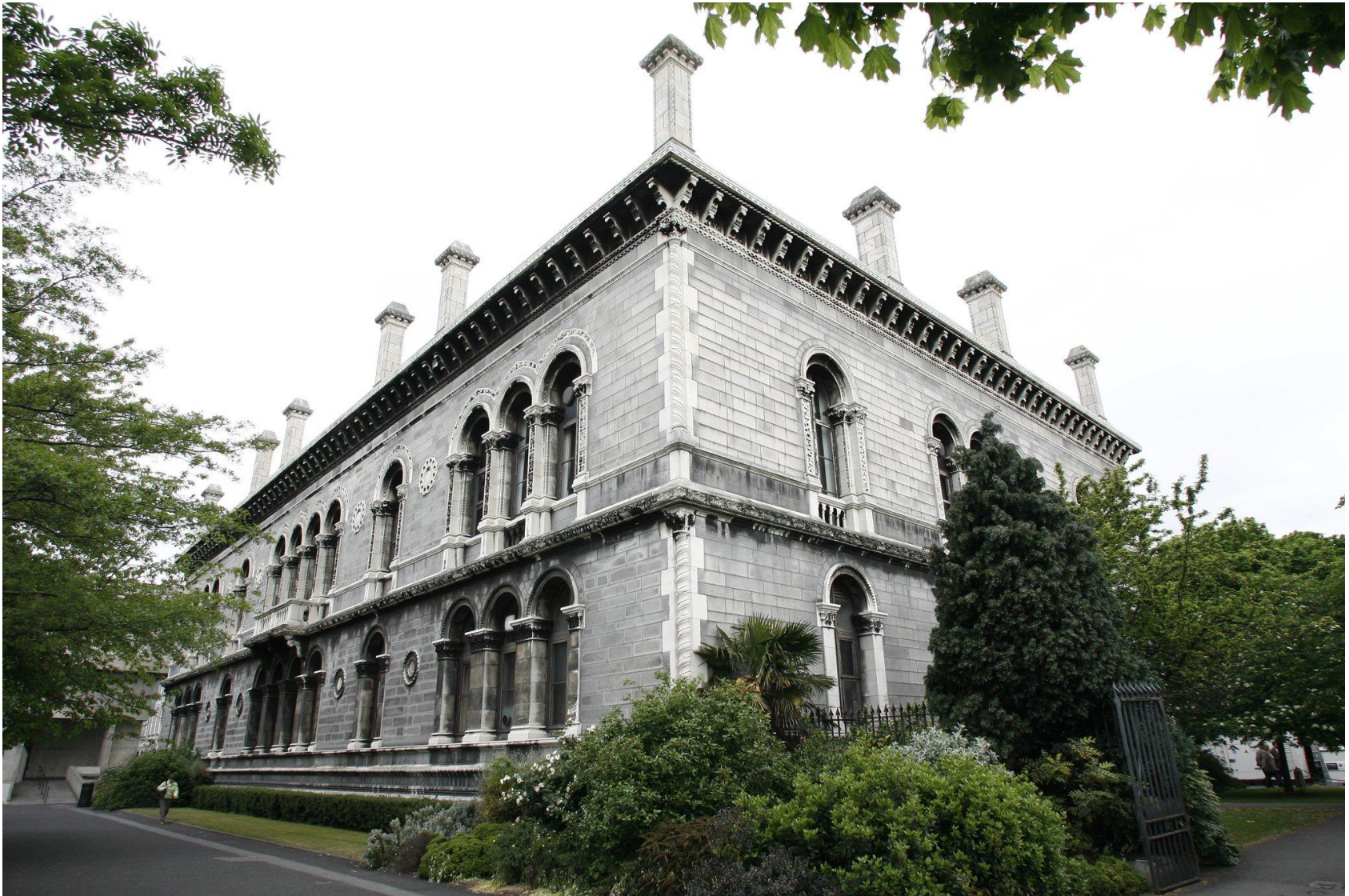
Acknowledgements

- FEL 3/04 Joint Venture Partners
 - ENI Ireland BV (Operator)
 - Repsol Exploracion Irlanda
 - Providence Resources plc
 - Sosina Exploration Limited
- Petroleum Affairs Division, Irish Government Department of Communications, Climate Action & Environment
- Previous FEL 3/04 Operator – ExxonMobil Exploration & Production (Offshore) Ireland Limited
- Trinity College Dublin
- American Association of Petroleum Geologists (European Region)

Introduction

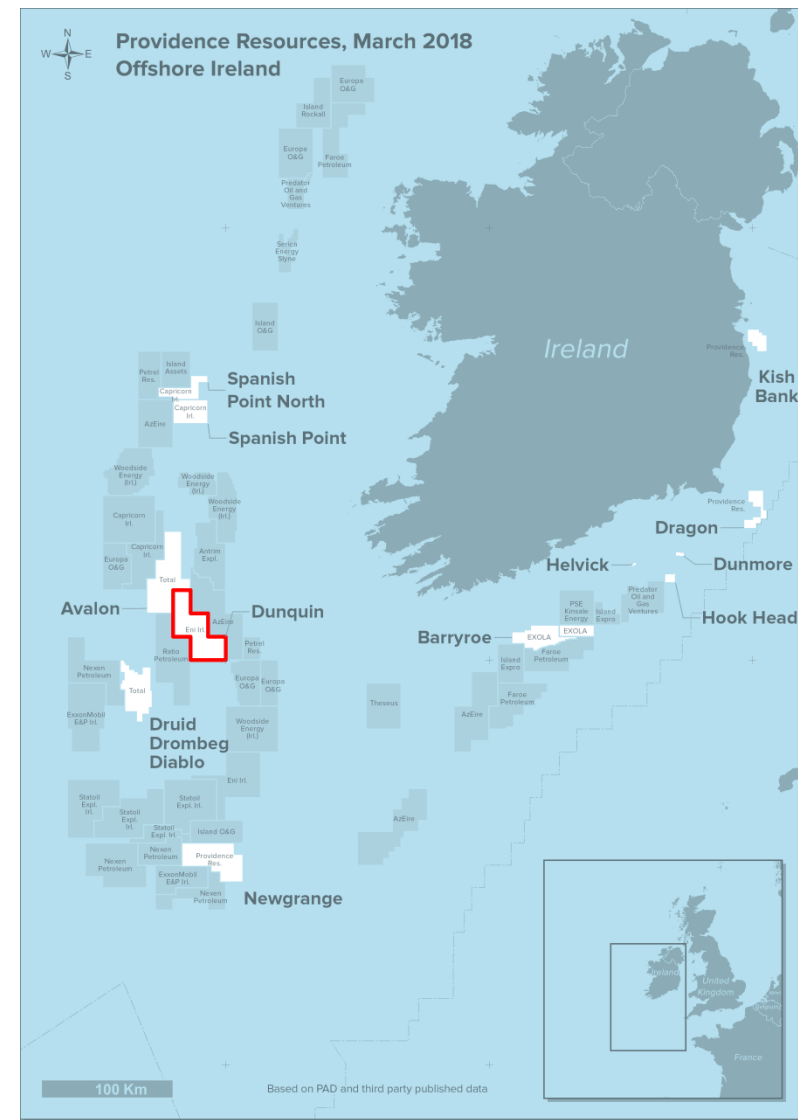
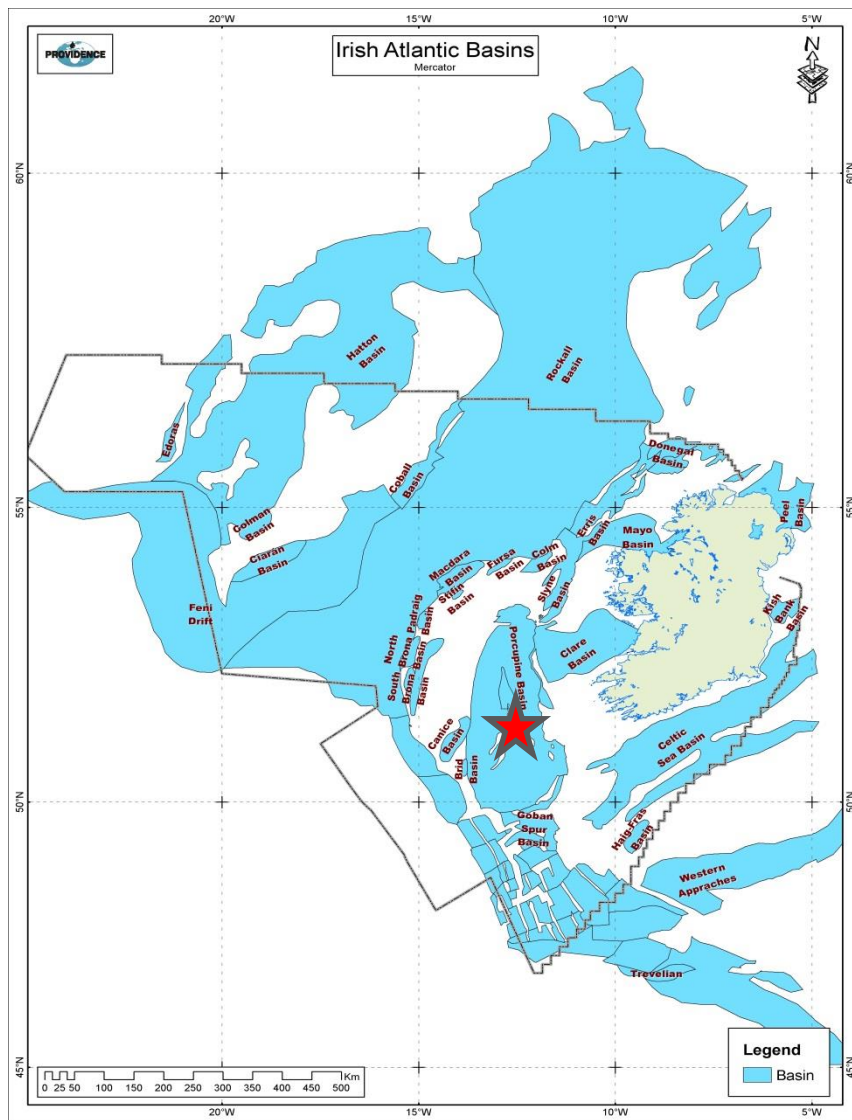
- Sparse vintage well & 2D seismic data suggested the potential presence of an extensive Lower Cretaceous carbonate province in the southern Porcupine Basin
- Published Lower Cretaceous trophic modelling studies indicate that conditions in the region would have been conducive to carbonate colonisation
- Exploration drilling targeting a primary Lower Cretaceous isolated carbonate platform play (**Dunquin North**) in the southern Porcupine Basin was undertaken in 2013 (ExxonMobil, 44/23-1)
 - Thematic set of carbonate papers to be presented at this conference for the first time (Providence, ENI & Repsol)
- The 44/23-1 well has proven the presence of potentially productive Lower Cretaceous carbonate reservoir systems in the southern Porcupine Basin
- A thick residual oil column was also encountered in these carbonates supporting the presence of a potentially prolific petroleum system

Introduction



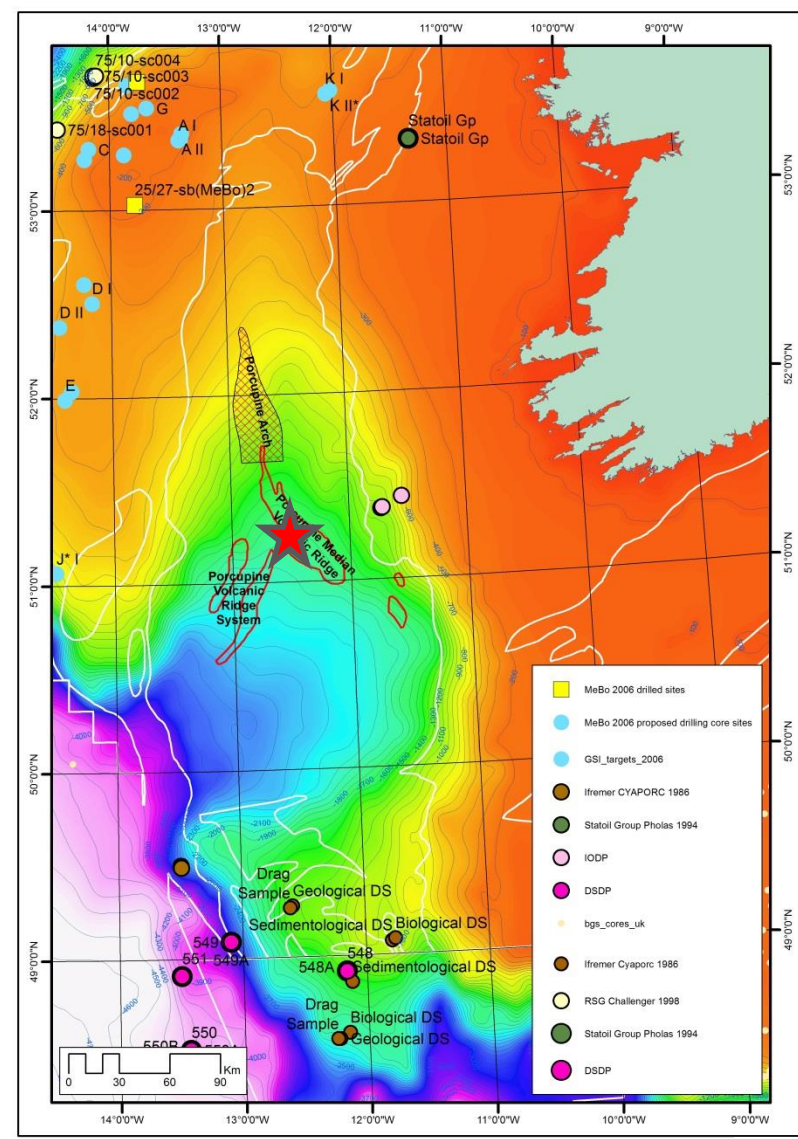
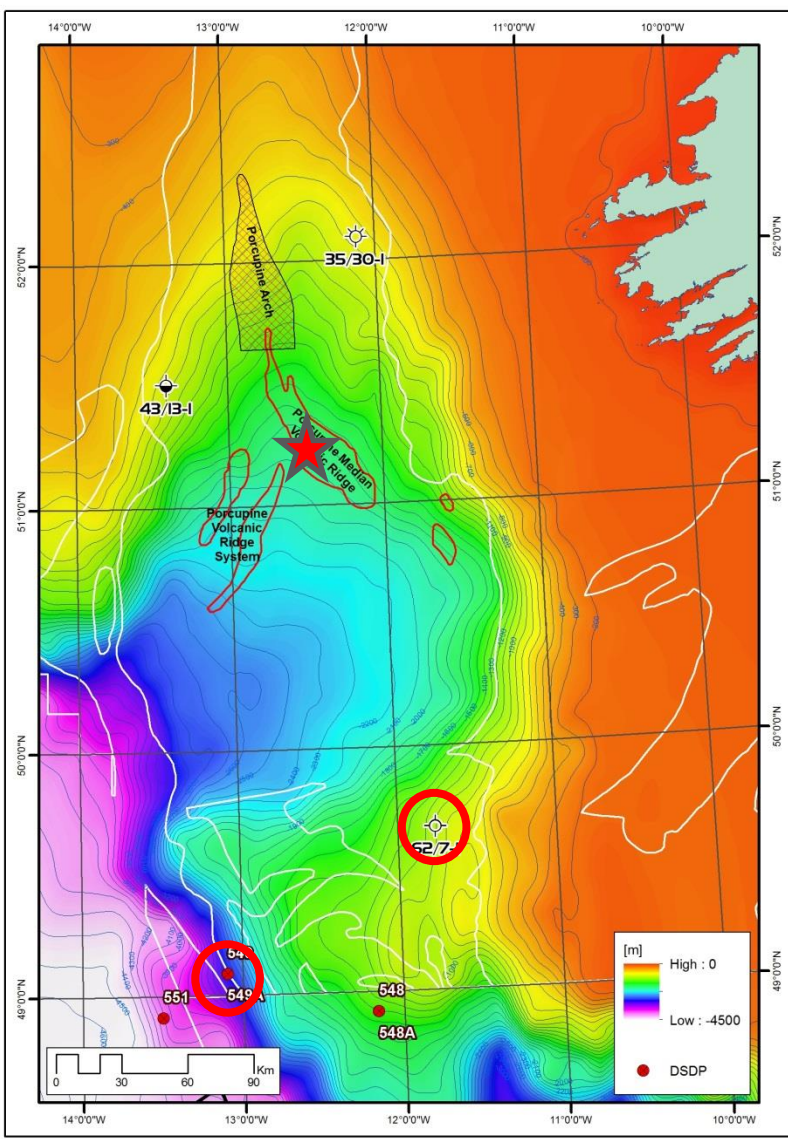
Geology Department, Trinity College, Dublin.....

Regional Setting – Location Map



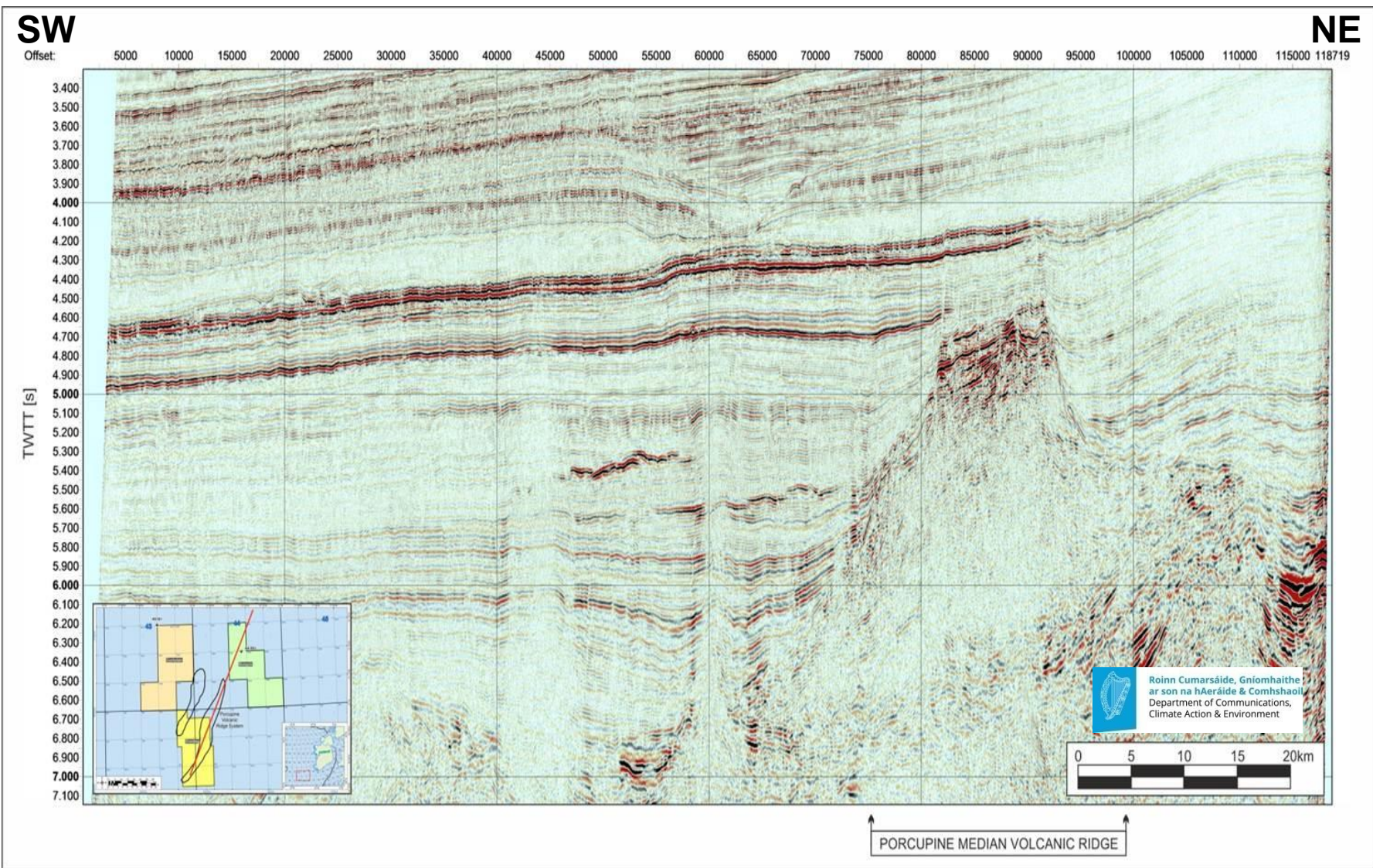
Frontier deep-water basin.....

Regional Setting – Well/Seabed Core Data



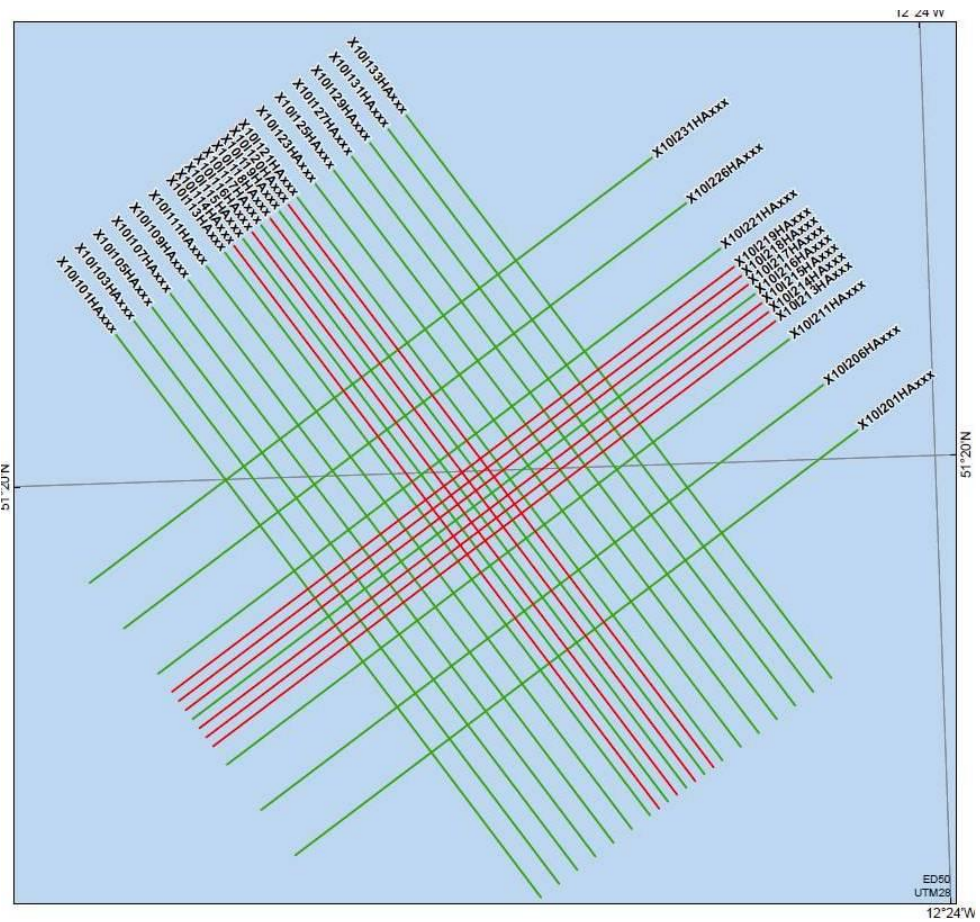
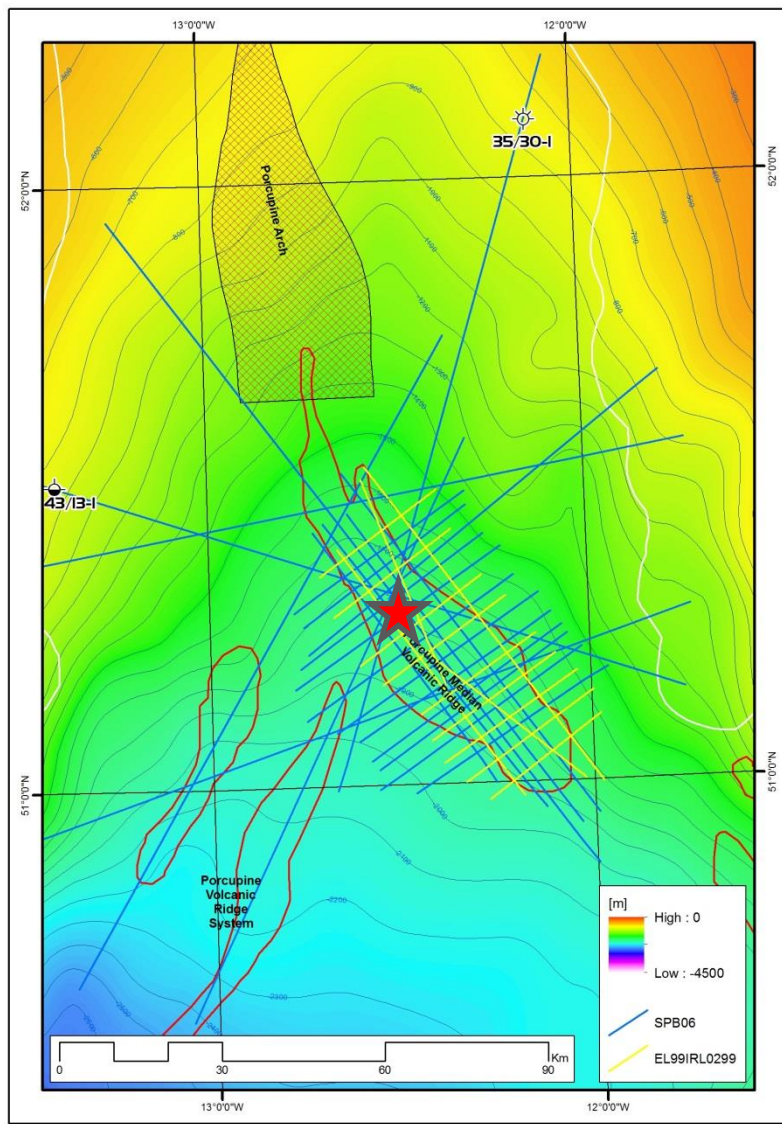
Limited well control.....

Regional Setting – Regional Seismic Line



Intra-basinal ridge as host for carbonate development.....

Regional Setting – 2D Seismic Data

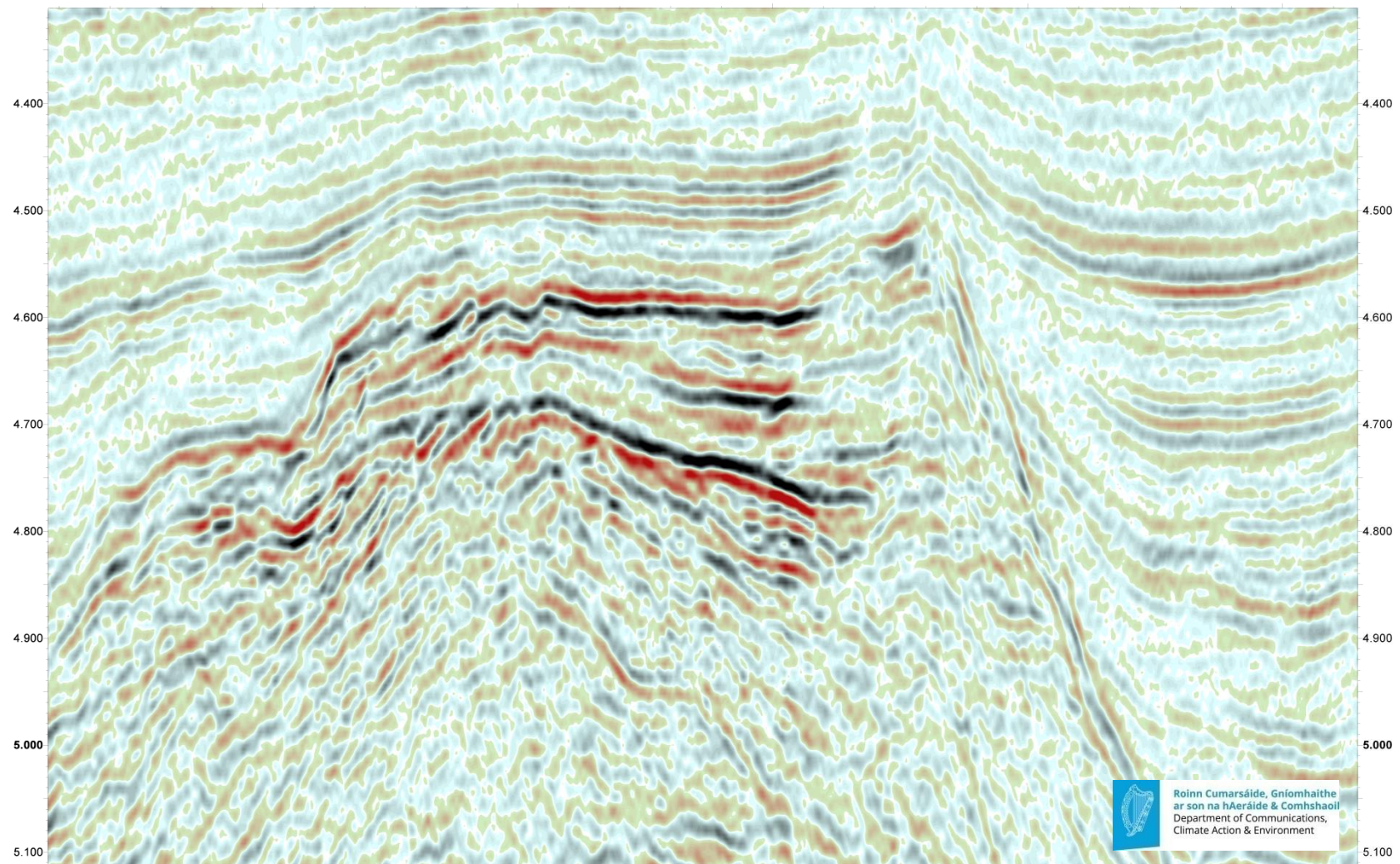



Limited 2D seismic reflection profiles.....

Regional Setting – Dunquin North: 2D Seismic Inline

SW 0299-001-52, 1710.65 SPB06-002A, 2250.36 SPB06-018B, 3705.81 0299-003-35P 0206-003A, 1998.05 0206-016A, 2483.30 SPB06-004A, 1732.49 NE

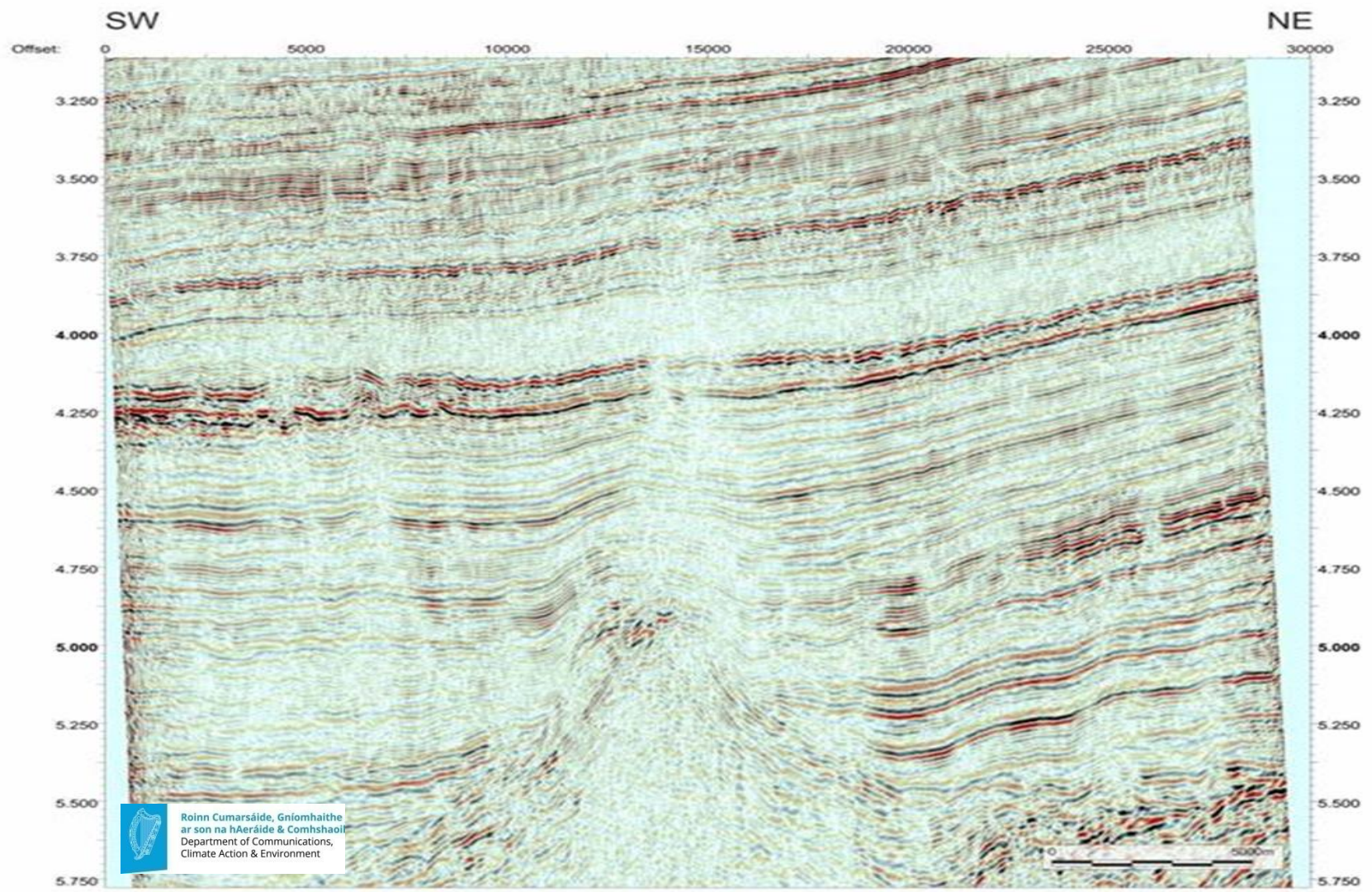
Offset: 25000 30000



 Roinn Cumarsáide, Gníomhaíthe ar son na hAeráide & Comhshaoil
Department of Communications, Climate Action & Environment

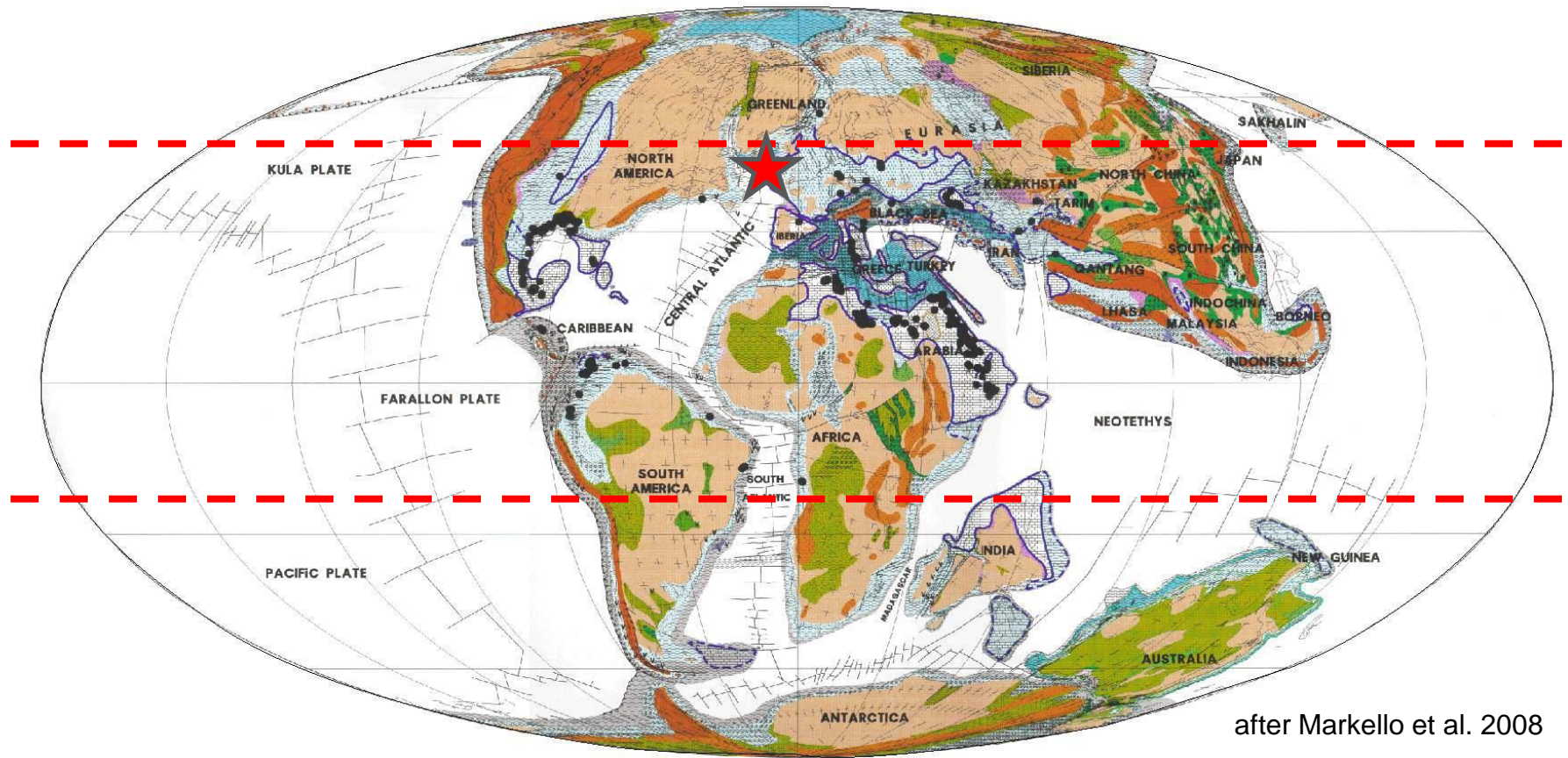
Marked asymmetric seismic morphology.....

Regional Setting – Dunquin North: Fluid Escape



Significant fluid escape features over Dunquin North.....

Regional Setting – CATT Map: Turonian – 90 Ma

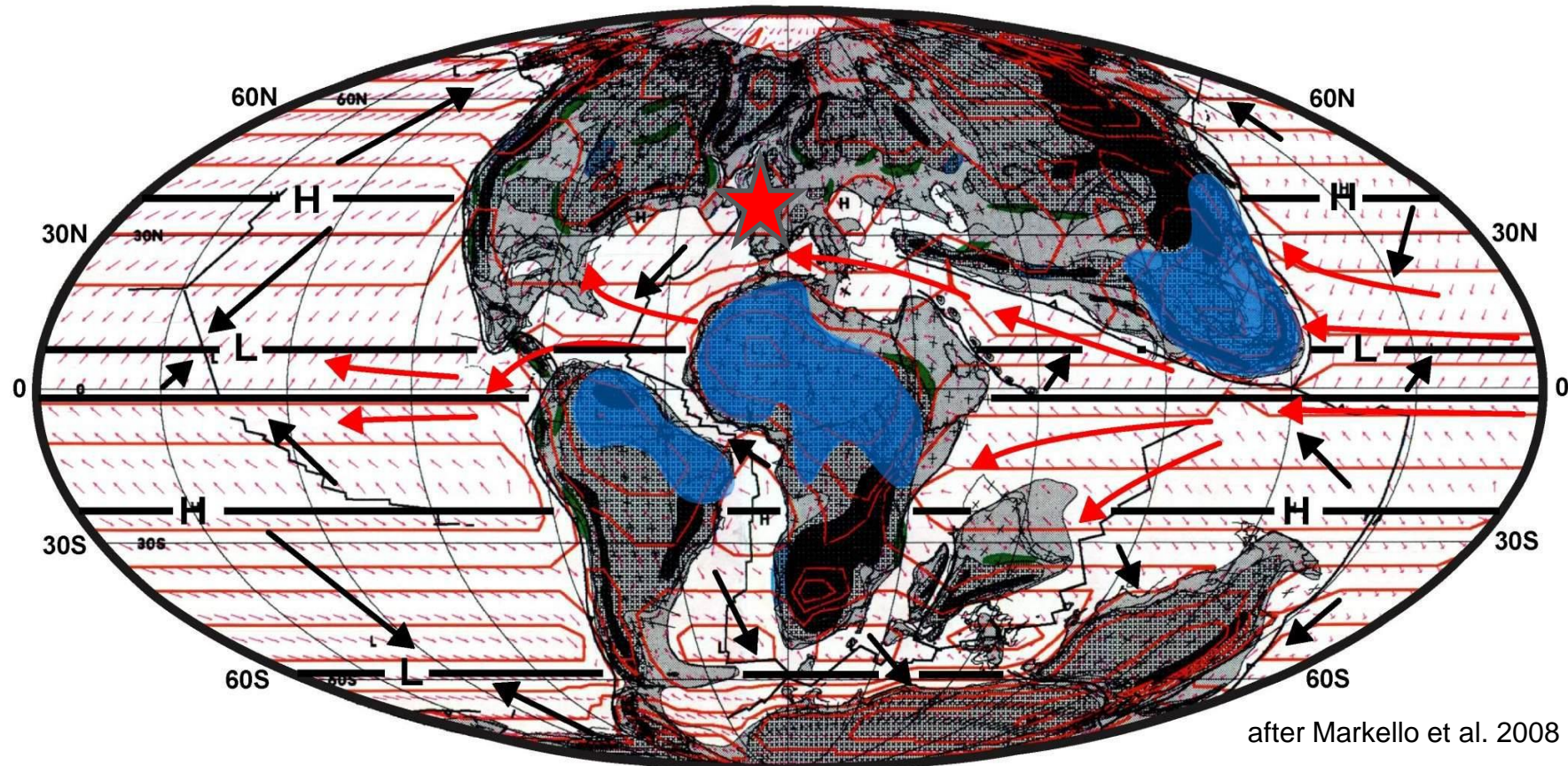


after Markello et al. 2008

Within the northern limit of known Cretaceous carbonate build-ups.....

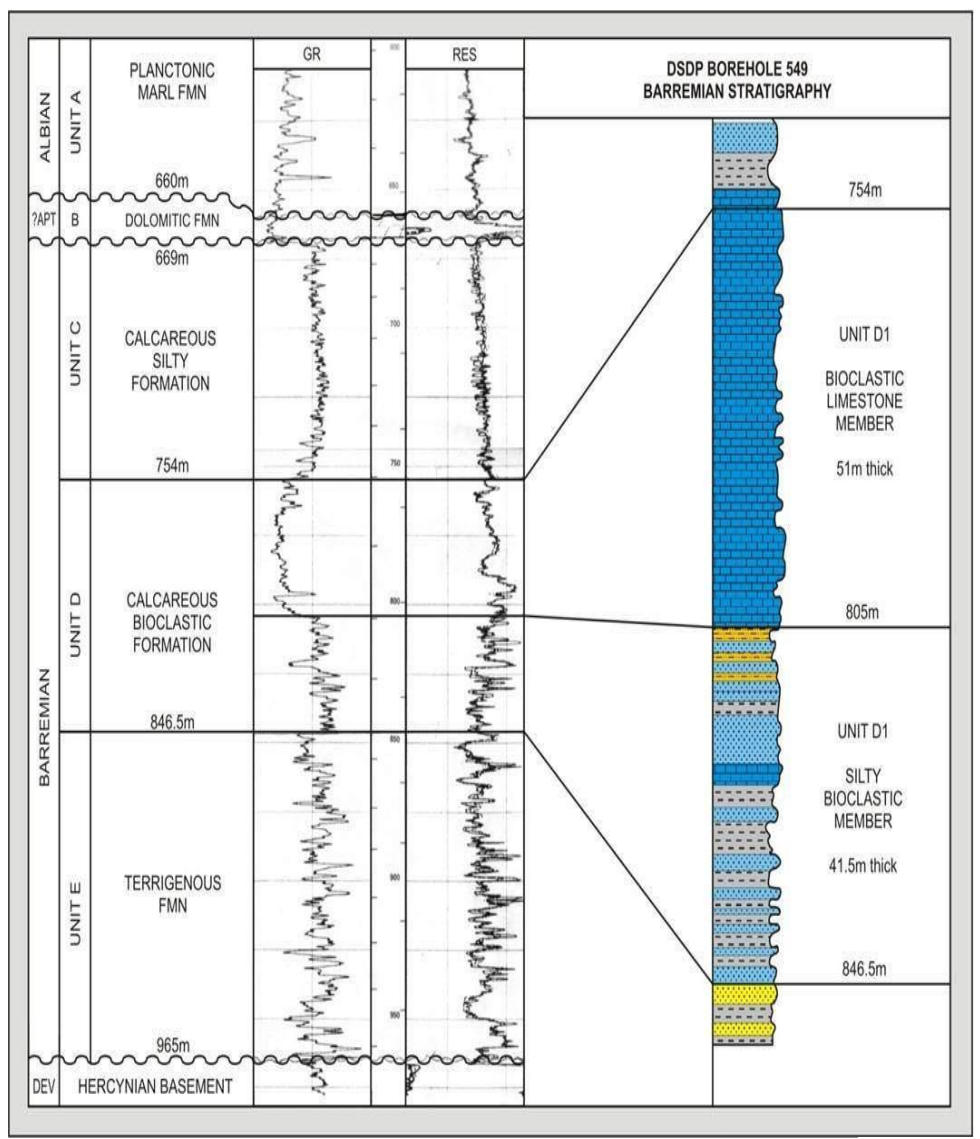
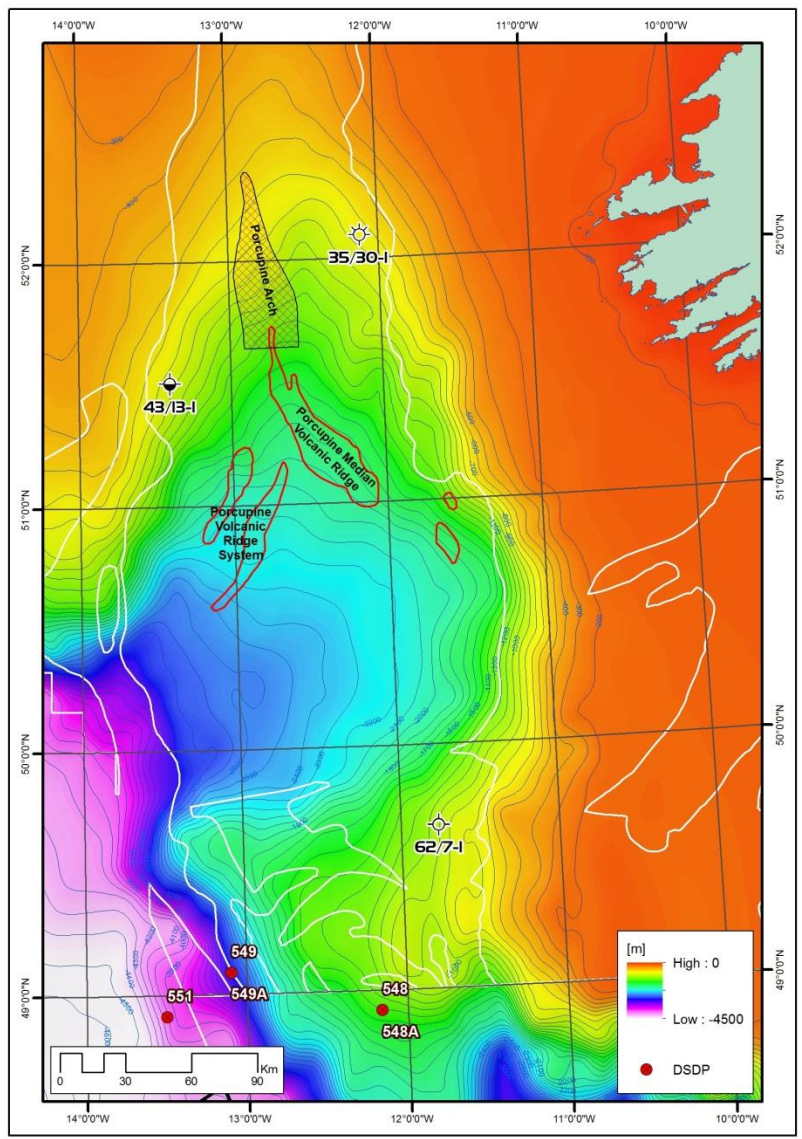
Regional Setting – CATT Map: Late Cretaceous – 88.8 Ma

Modelled Paleoclimates & Winds & Interpreted Hurricane Tracts



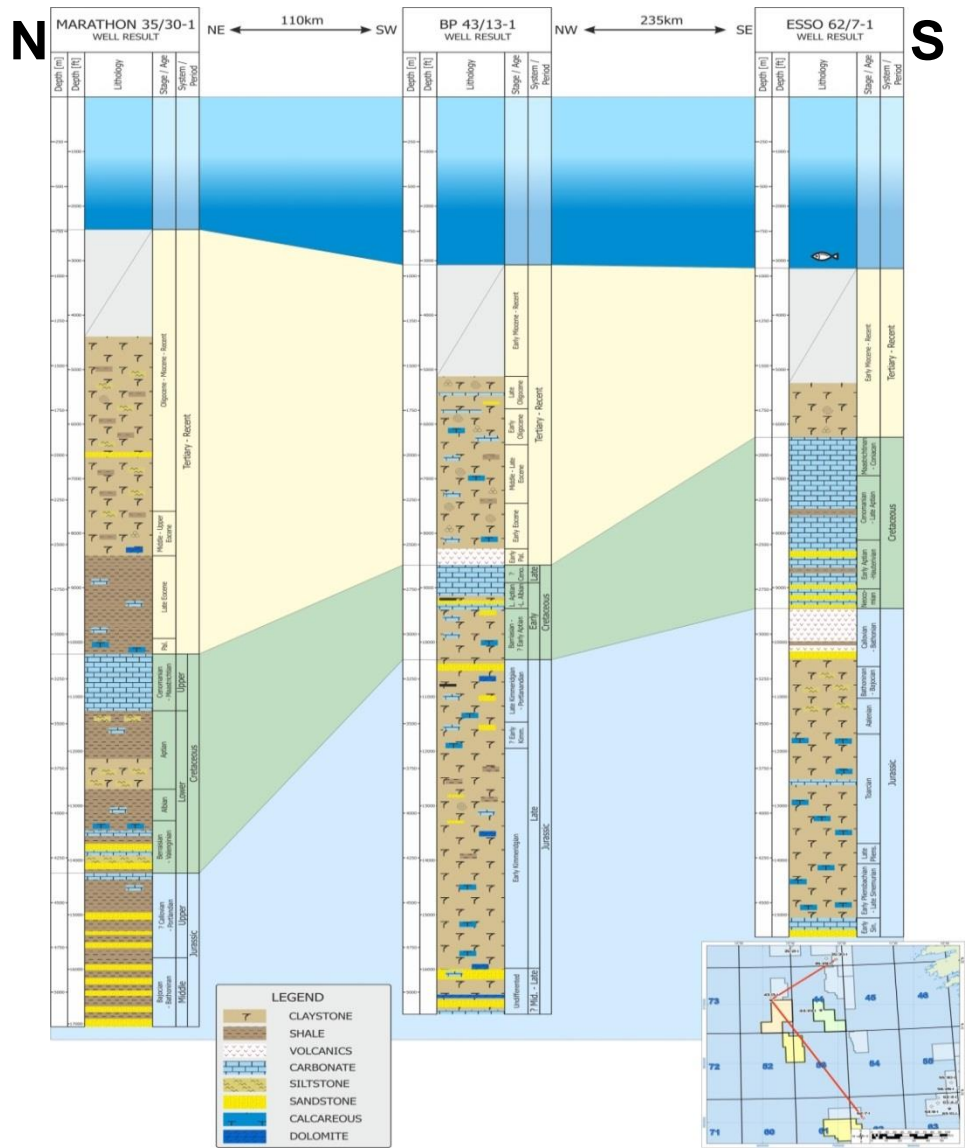
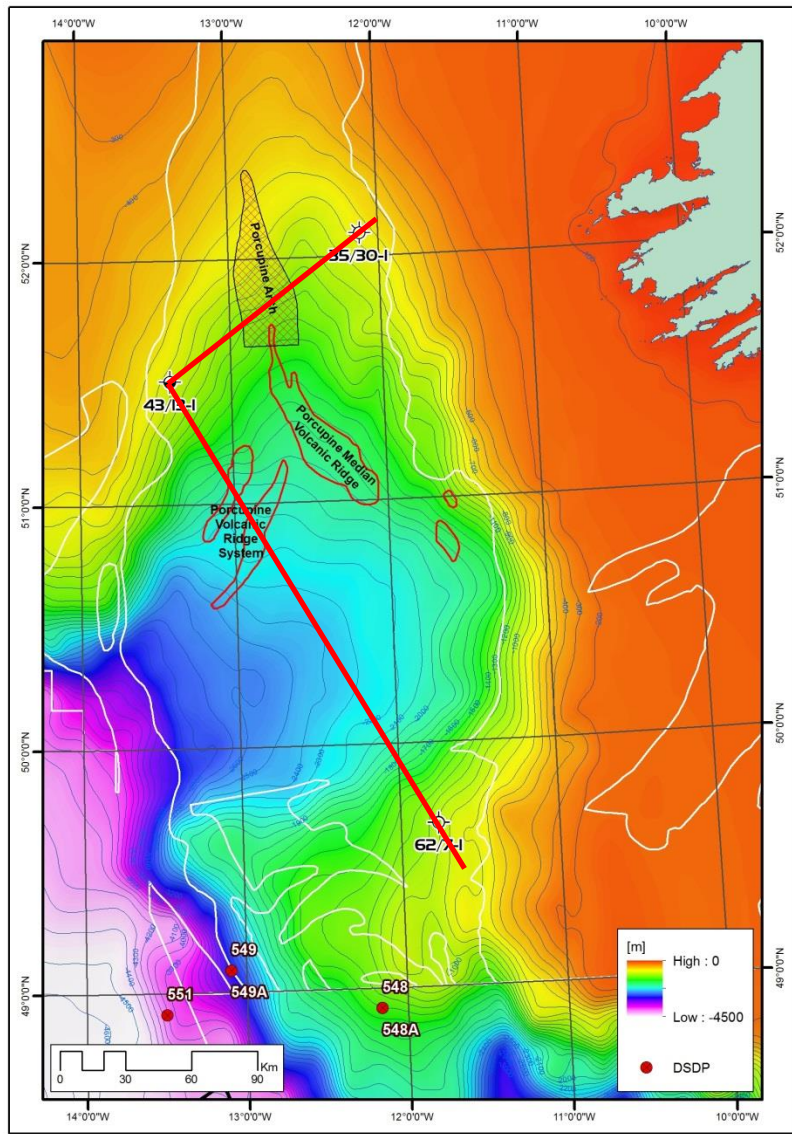
Prevailing paleo-wind direction from the NE.....

Regional Setting – Goban Spur: ODP Leg 80 DSDP 549 (1981)



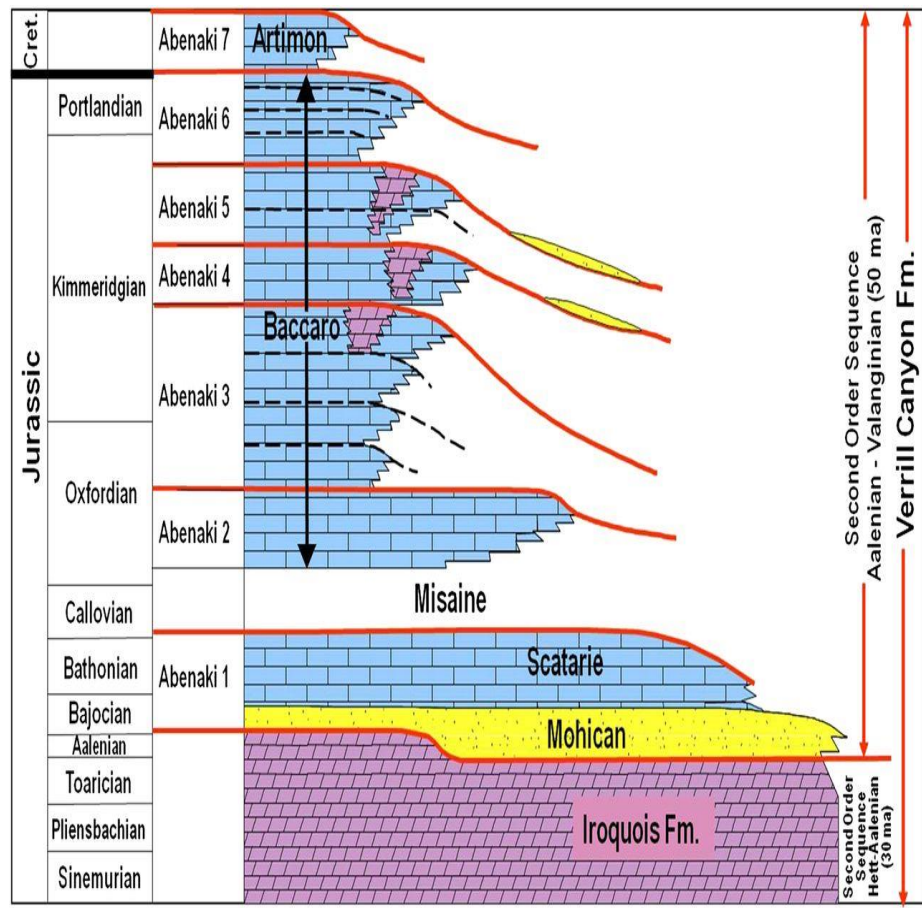
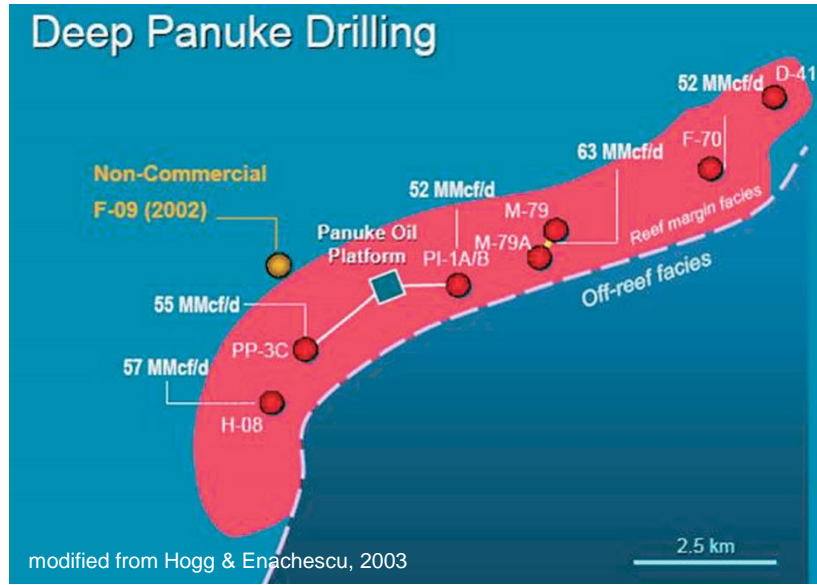
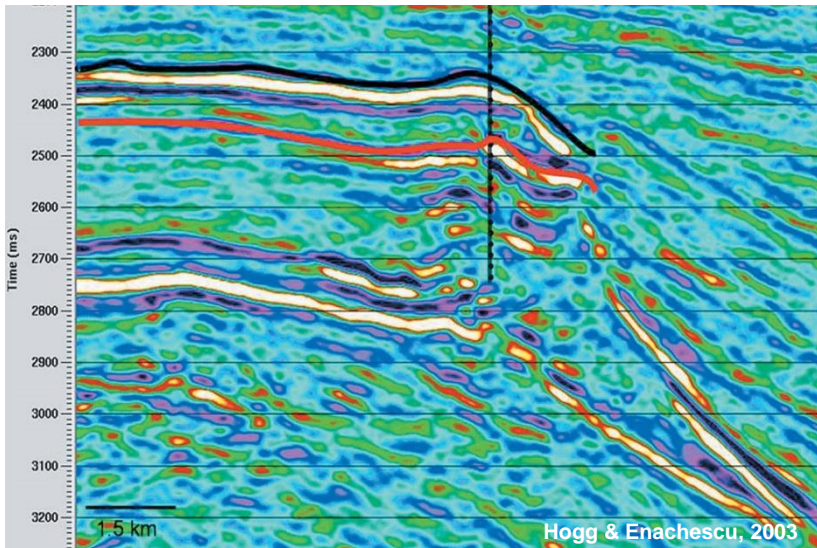
Lower Cretaceous carbonates proven on the Goban Spur.....

Regional Setting – Well Correlation Panel



Are Lower Cretaceous carbonates present in the Porcupine.....?

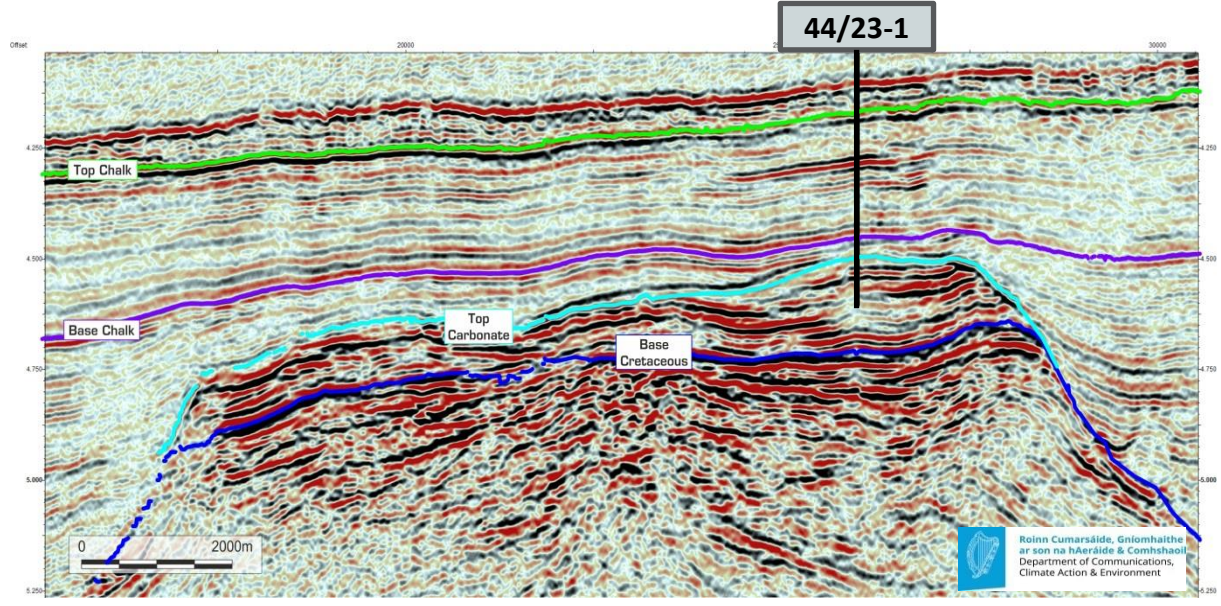
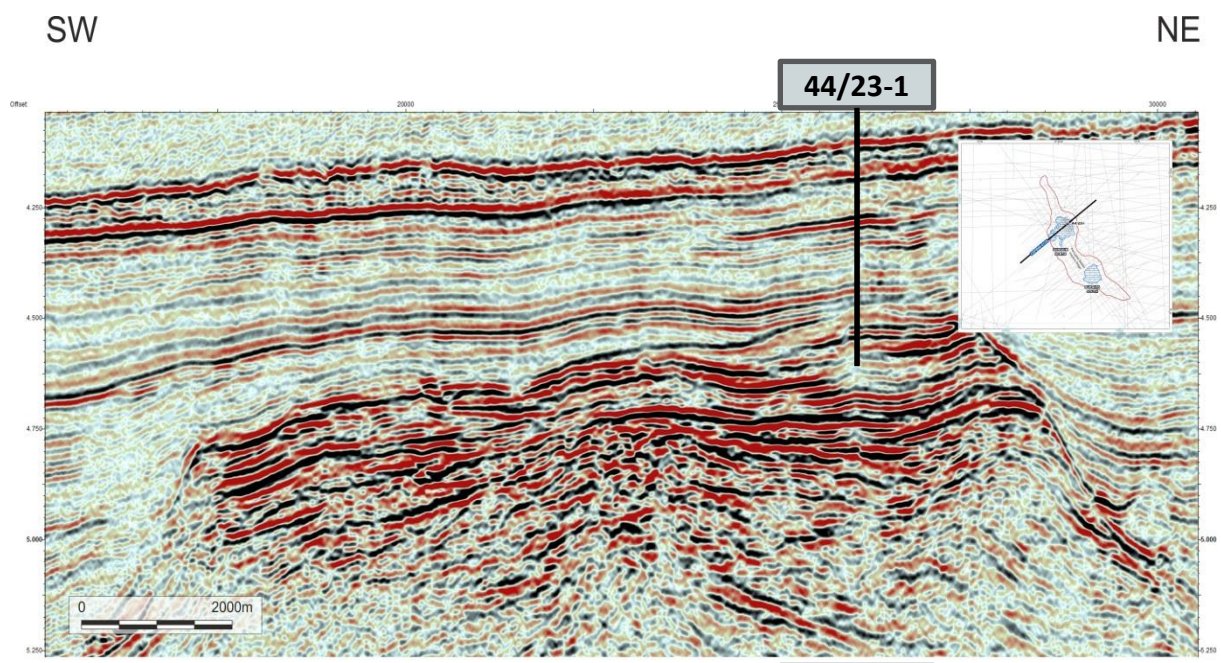
Regional Setting – Conjugate Analogues: Deep Panuke Field



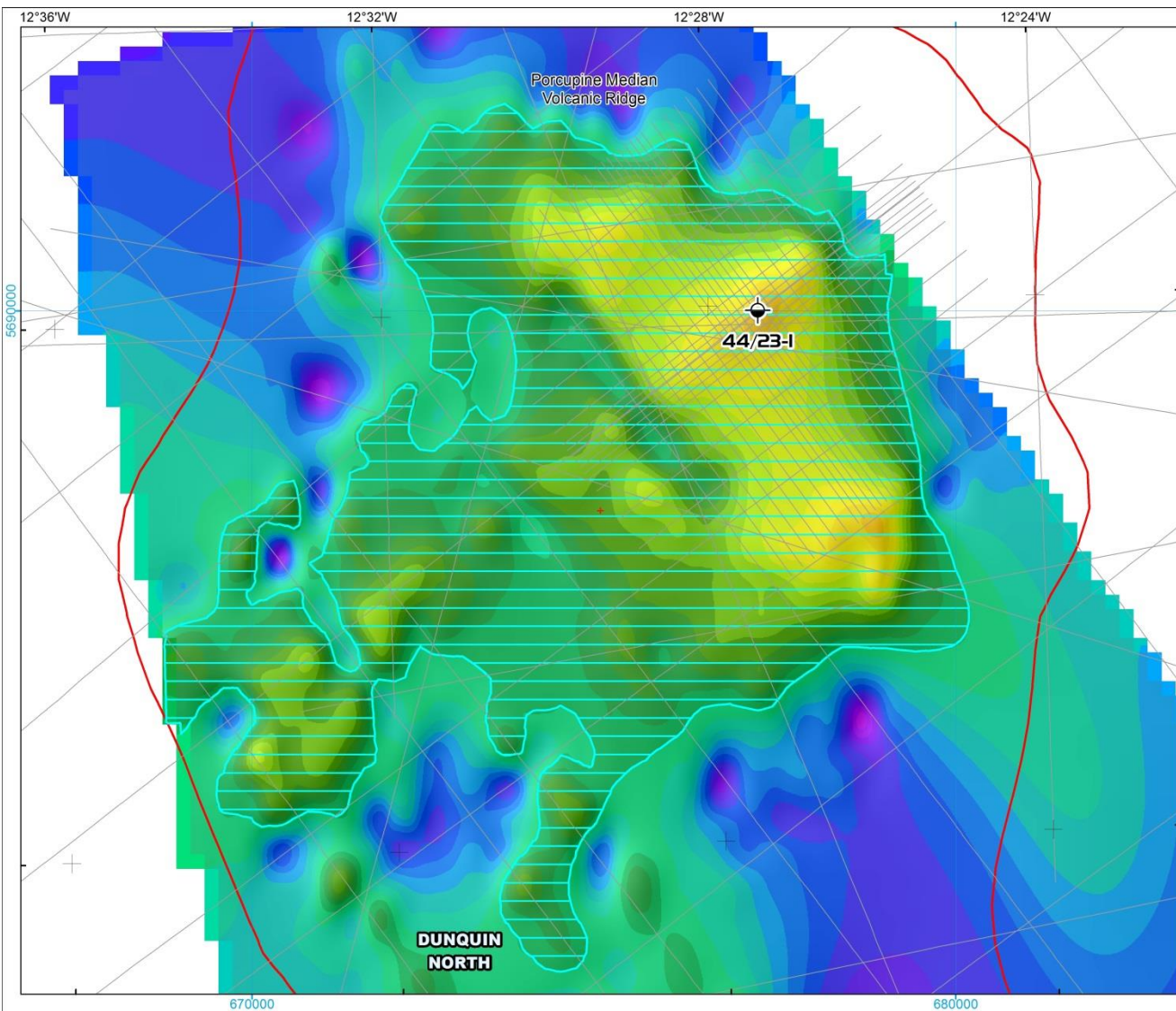
Harvey & MacDonald 2013

Deep Panuke field offshore Nova Scotia possible analogue....

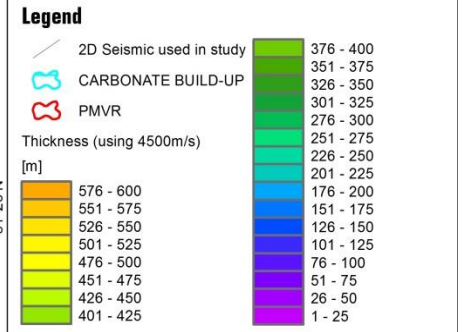
Pre-Drill Prognosis – Dunquin North: 2D Seismic Inline



Pre-Drill Prognosis – Dunquin North: Carbonate Isochron



Porcupine B.-Thickness Carbonate [m] Seismic Coverage, Build-up and PMVR

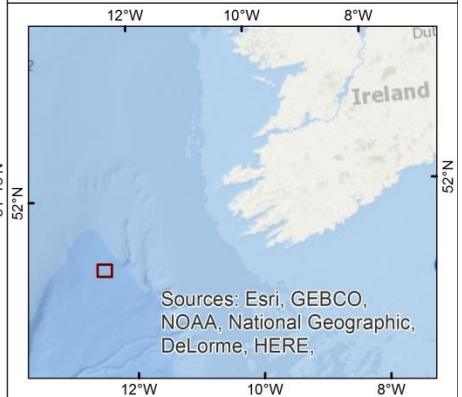


Coordinate System: ED 1950 UTM Zone 28N
 Projection: Transverse Mercator
 Datum: European 1950
 False Easting: 500,000,000
 False Northing: 0,000
 Central Meridian: -15,0000
 Scale Factor: 0,9996
 Latitude Of Origin: 0,0000
 Units: Meter

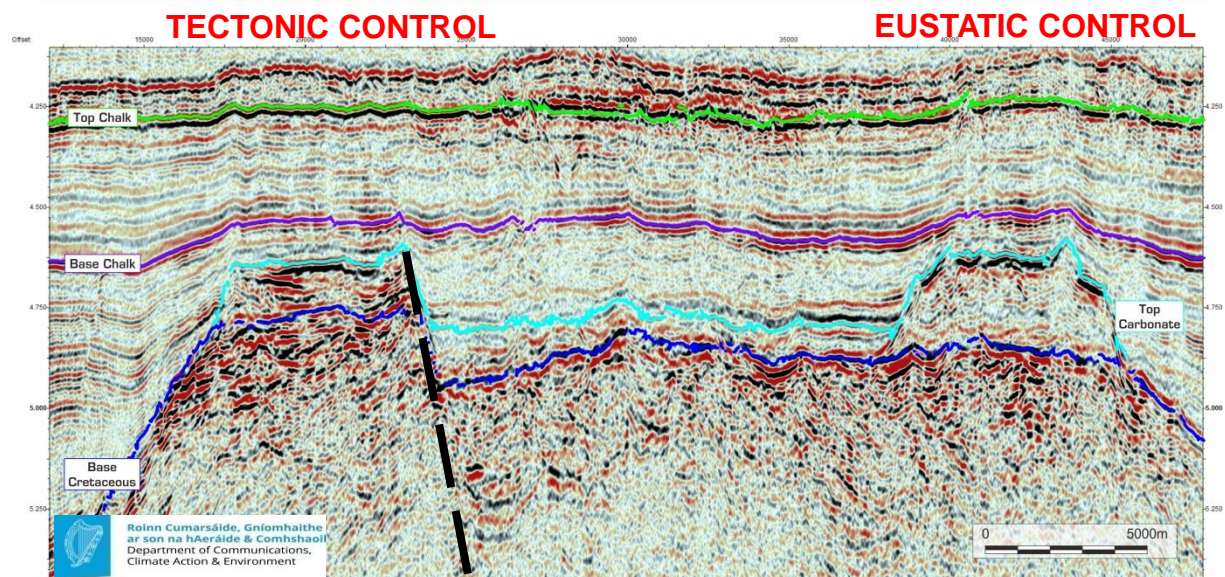
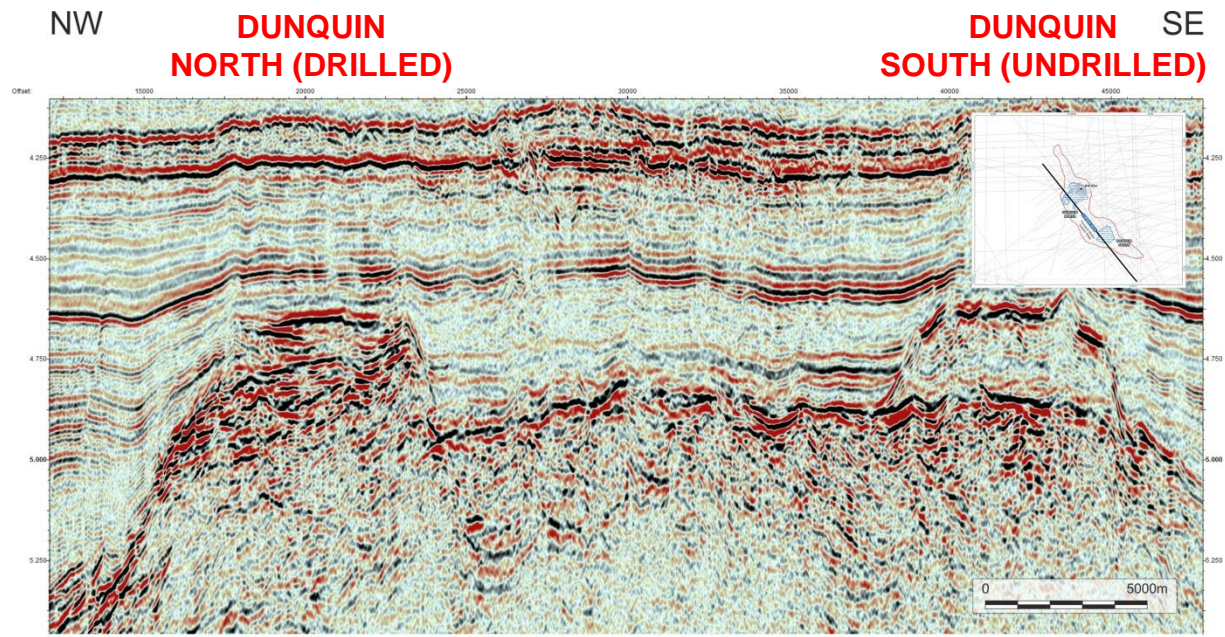
Scale: 1:90000	1 cm = 900 m
Date Saved: 28/02/2014 14:40:53	Scale@: 155x253
Date Exported: 28/02/2014 14:41:24	(pres.)
Drawn by: JC	

Center Point:
 Long/Lat: 12°29'24.194"W 51°18'30.251"N
 XY [m]: 674,948 5,687,230

Ref./file Name: 20140228-PRES-THICKNESS CARBONATE-SPLINE-BUILD-UP-4

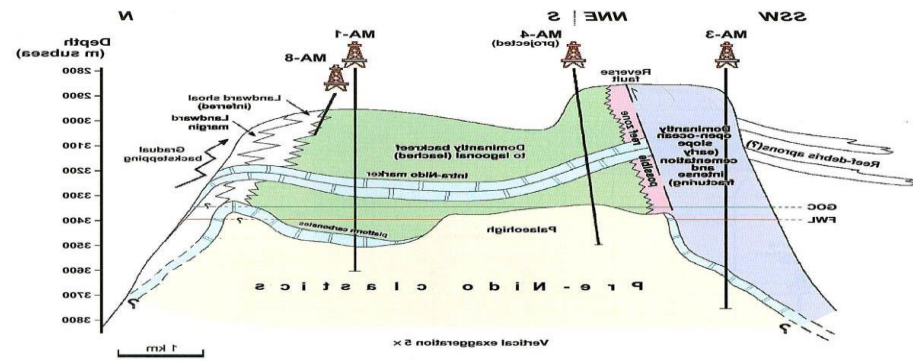


Pre-Drill Prognosis – Dunquin North vs Dunquin South

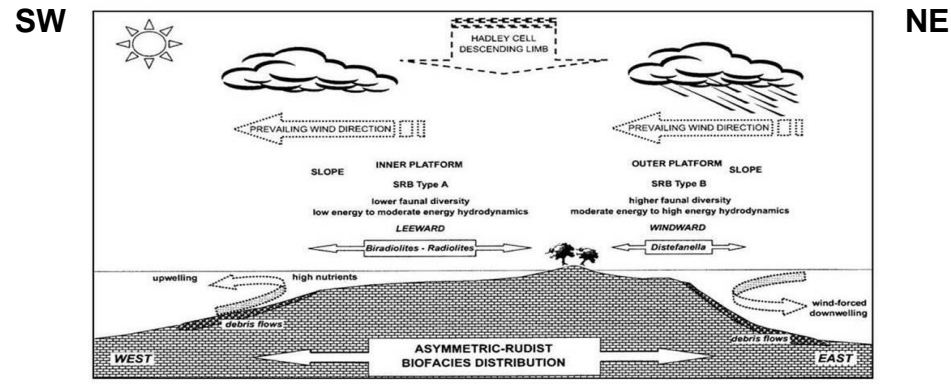


Roinn Cumarsáide, Gníomhaíthe ar son na hAeráide & Comhshaoil
 Department of Communications, Climate Action & Environment

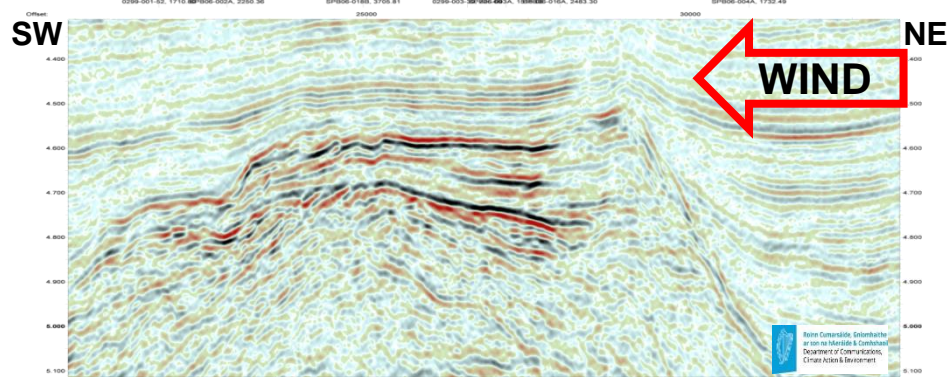
Pre-Drill Prognosis – Dunquin North: Subsurface Analogue



after Neuhaus et al. 2004



Cestari et al, 2007



Pre-Drill Prognosis – Dongsha Atoll: Surface Analogue



Picture by CPAMI

Dongsha Atoll (South China Sea) possible modern day analogue....

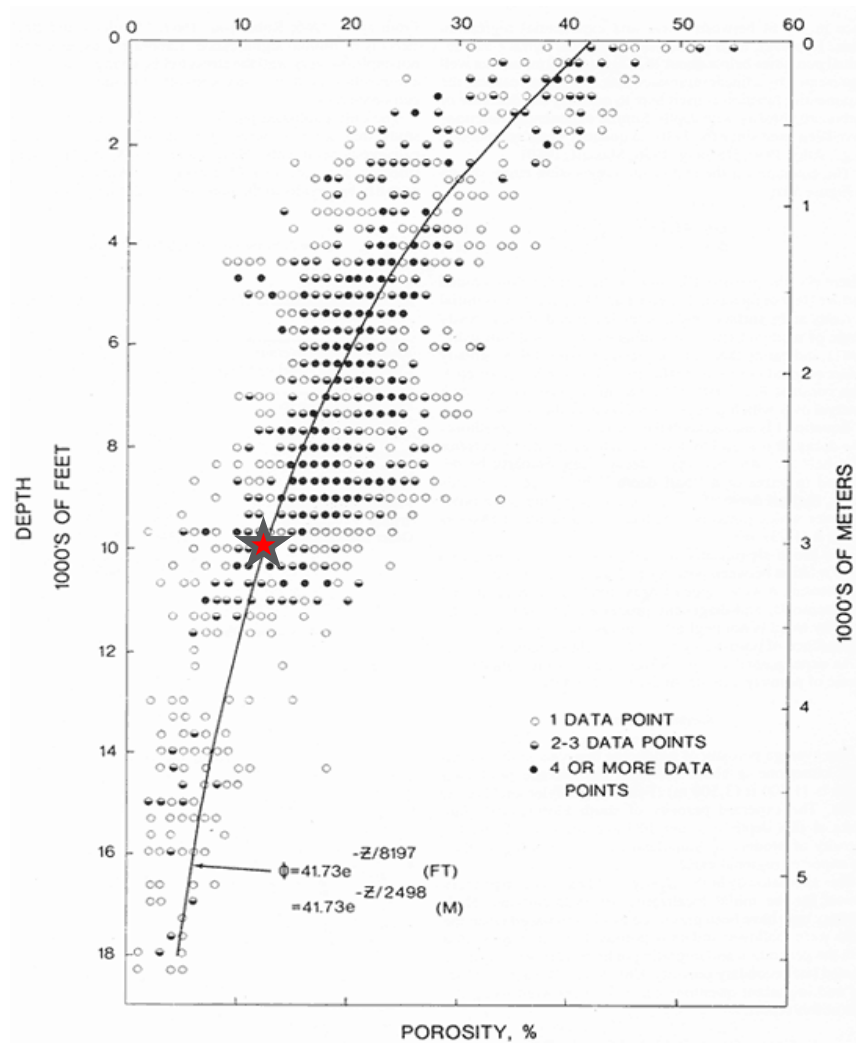
Pre-Drill Prognosis – Dunquin North: Rudists?



www.paleotax.de

Rudist reef builders were prognosed to be potentially present....

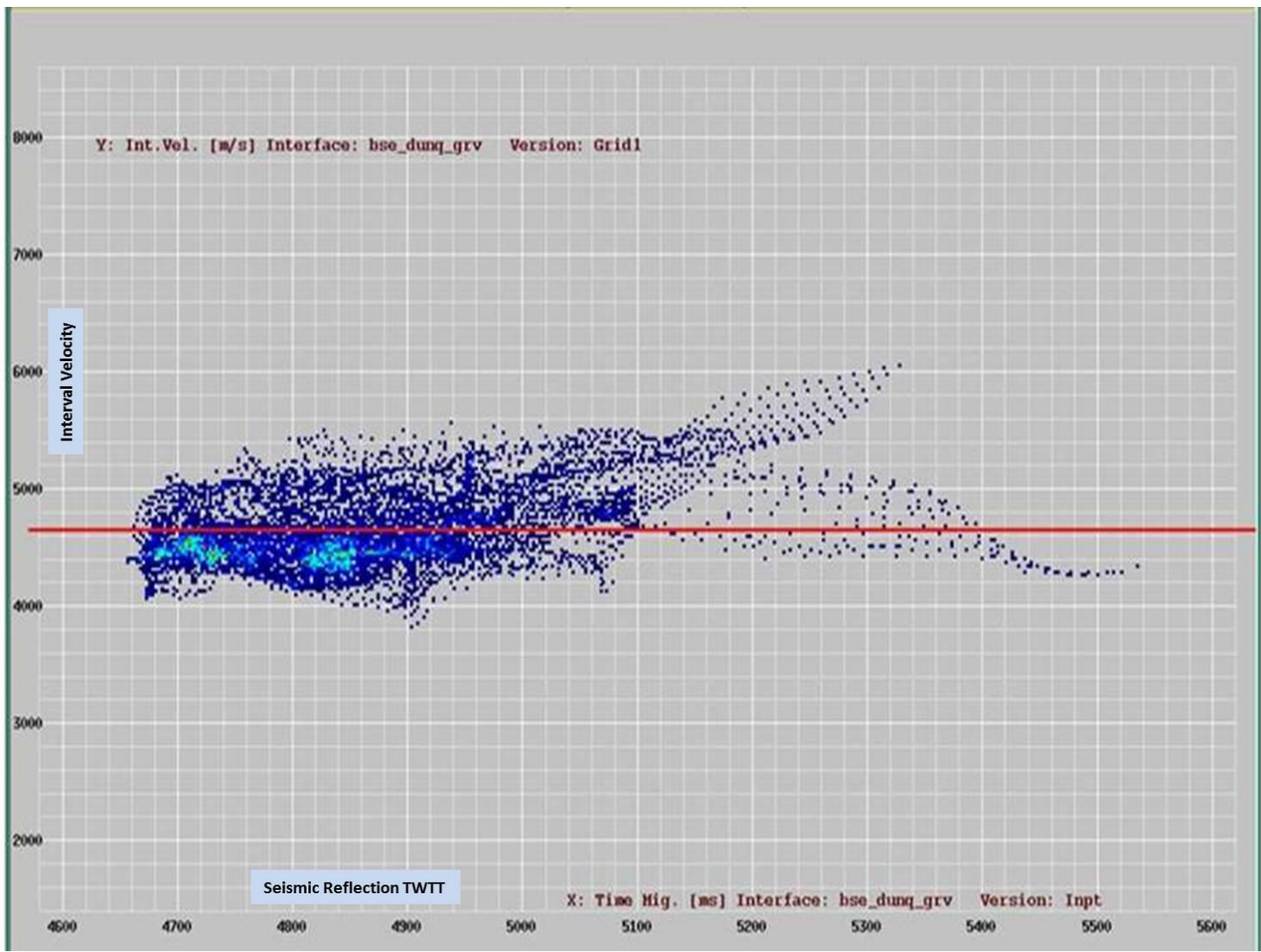
Pre-Drill Prognosis – Carbonate Porosity/Depth Prediction



after Halley & Schmoker 1983

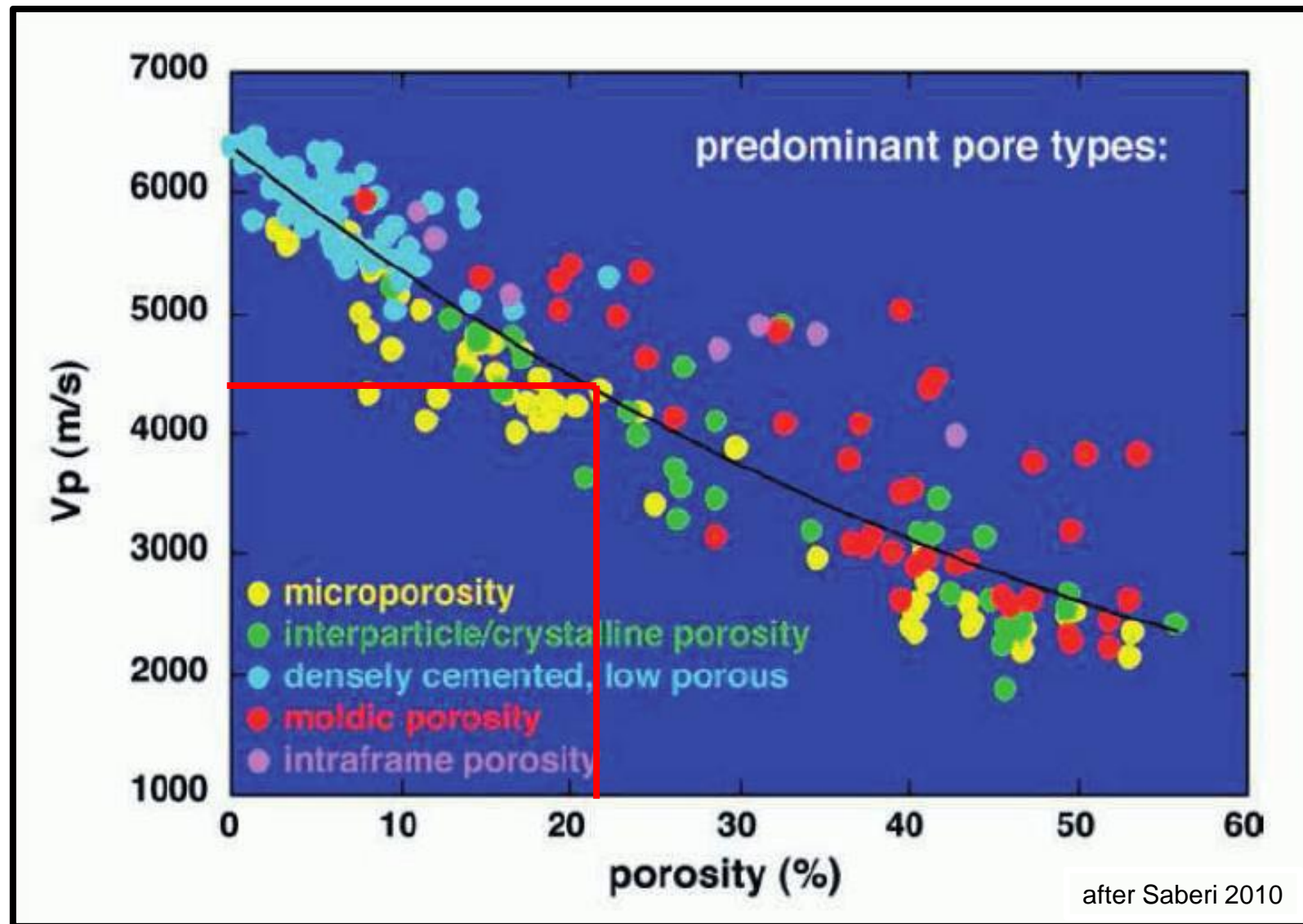
Depth BML predicts low 10%'s porosity....

Pre-Drill Prognosis – Carbonate Interval Velocity Analysis



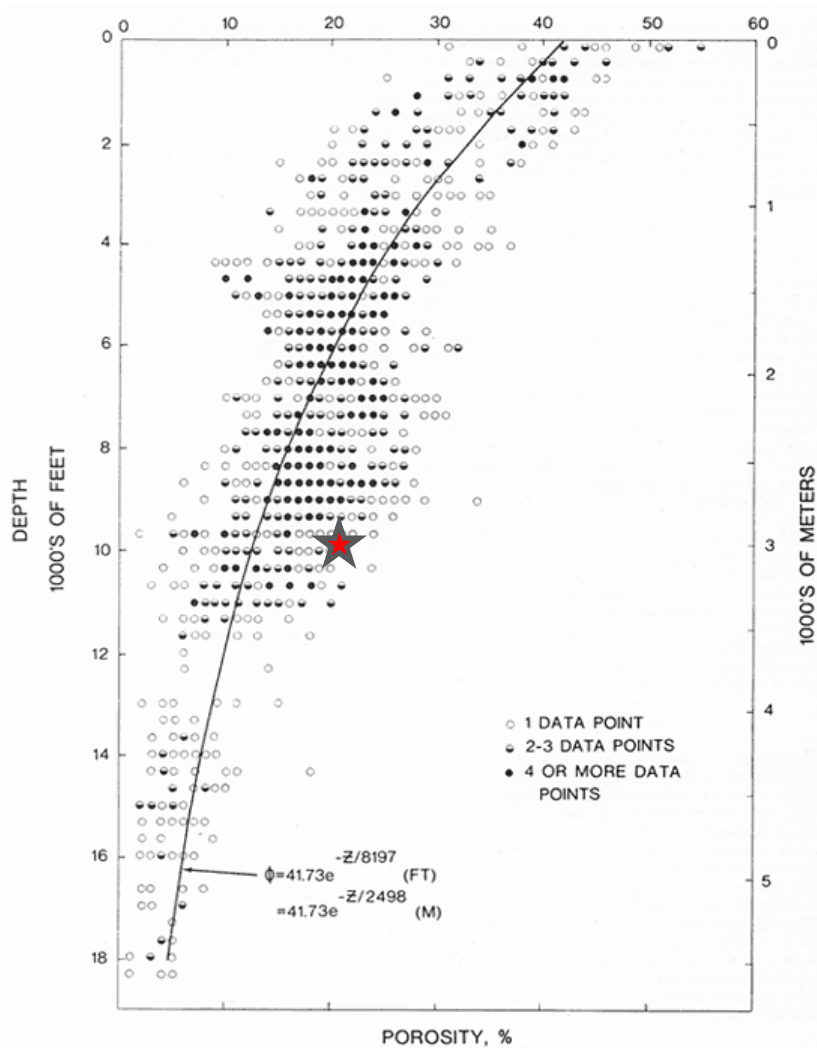
Actual seismic reflection-derived Vint of c. 4,400 metres/sec....

Pre-Drill Prognosis – Carbonate Porosity/Vint Prediction



Seismic reflection-derived Vint predicts low 20%'s porosity....

Pre-Drill Prognosis – Carbonate Porosity/Depth/Vint Prediction



after Halley & Schmoker 1983

Mismatch between depth and Vint porosity predictions – possible fluid effect....?

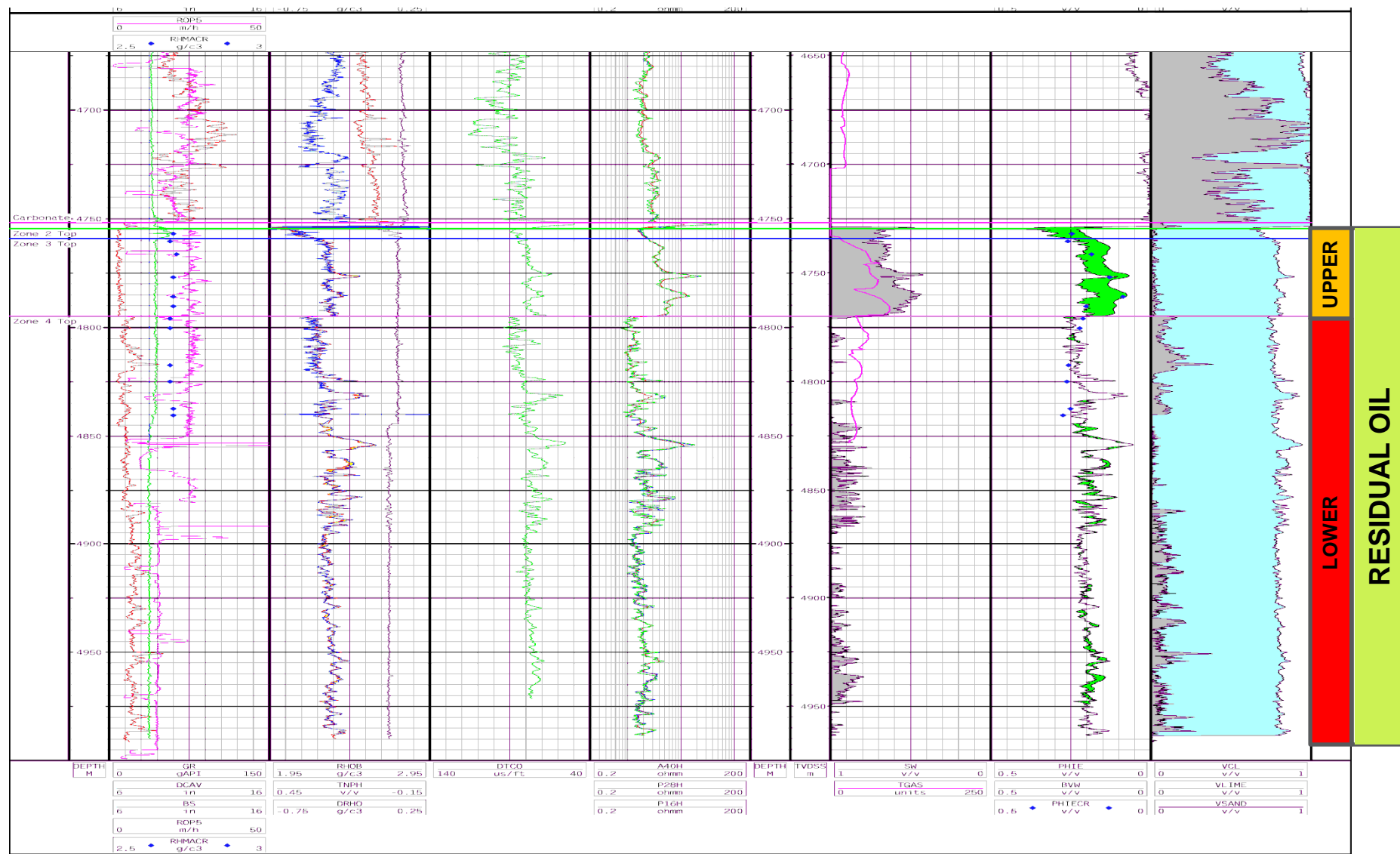
Well Results – Drilling



Courtesy Ronayne Shipping

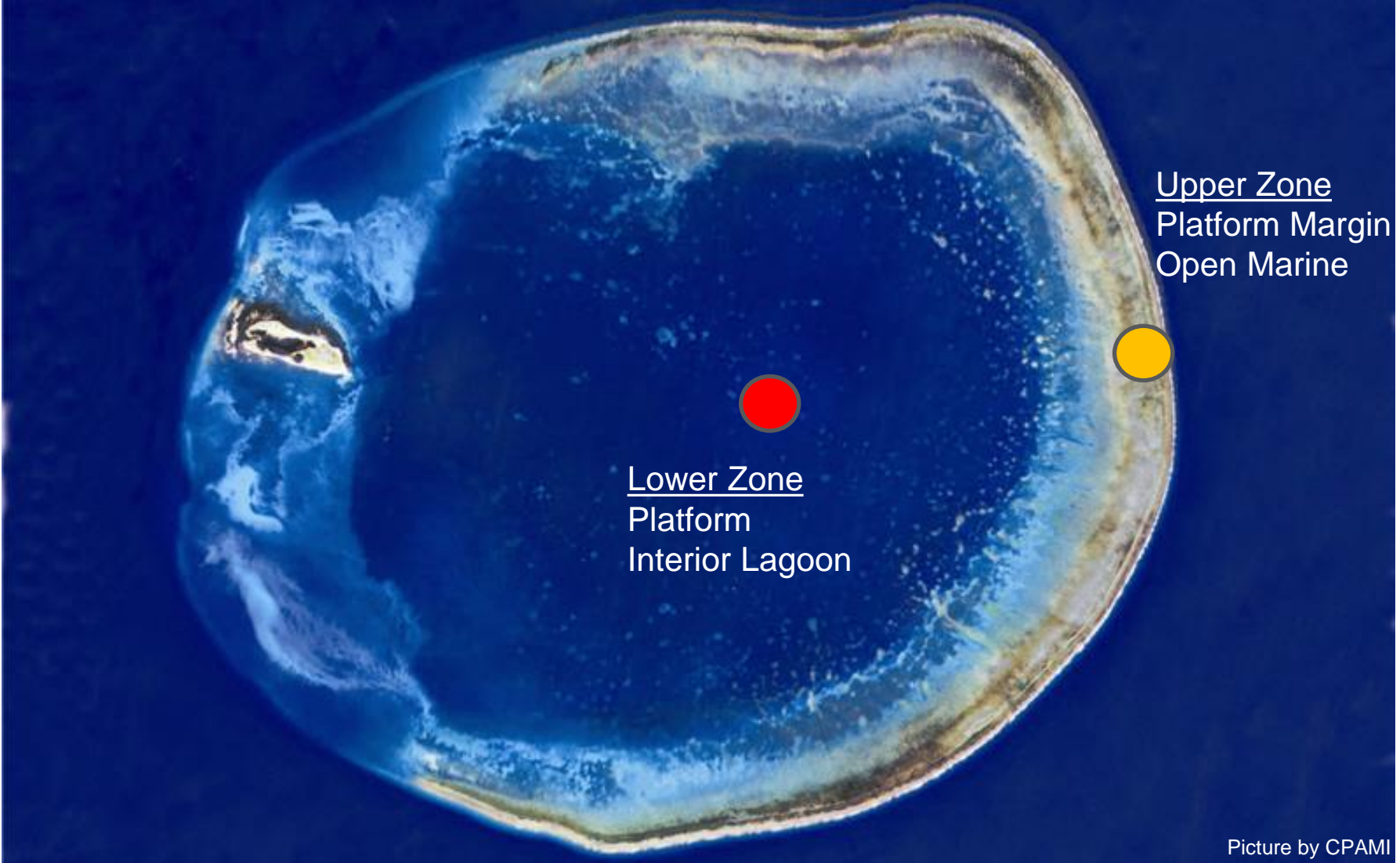
Dunquin North 44/23-1 well drilled using the Eirik Raude SS MODU.....

Well Results – Petrophysical Interpretation



Significant residual oil column in massive porous over-pressured Lower Cretaceous carbonate reservoir...

Post-Well Studies – Dunquin North: Interpreted EOD



Picture by CPAMI

2D seismic morphological analysis correctly predicted Environment of Deposition.....

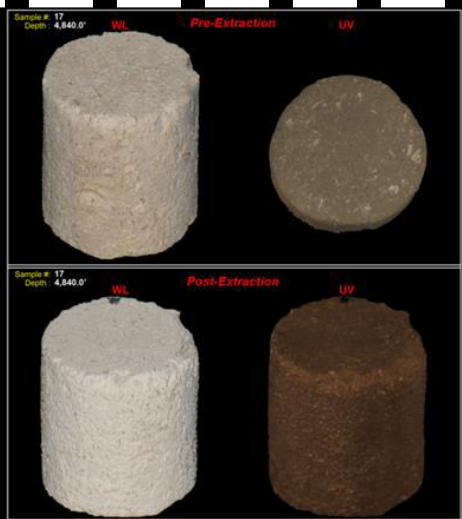
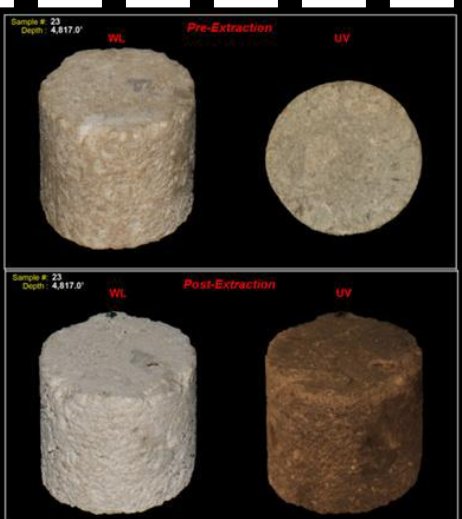
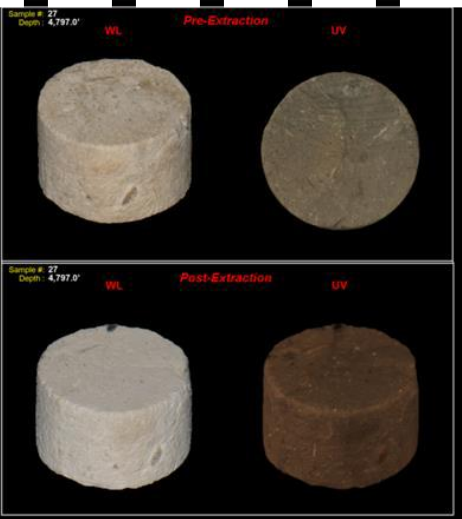
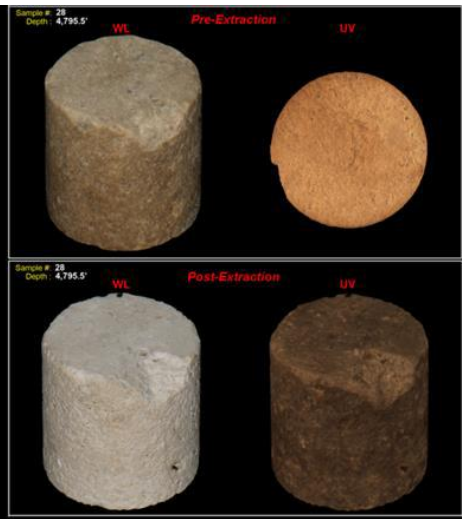
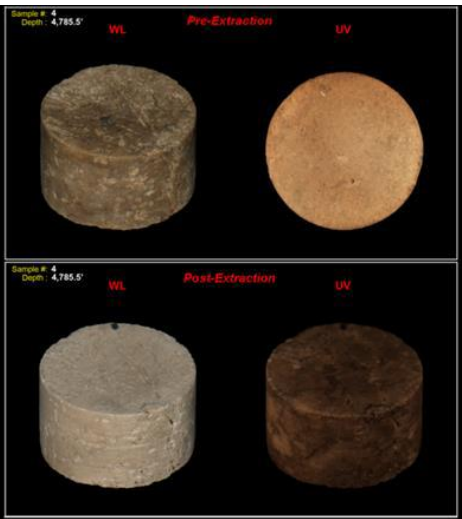
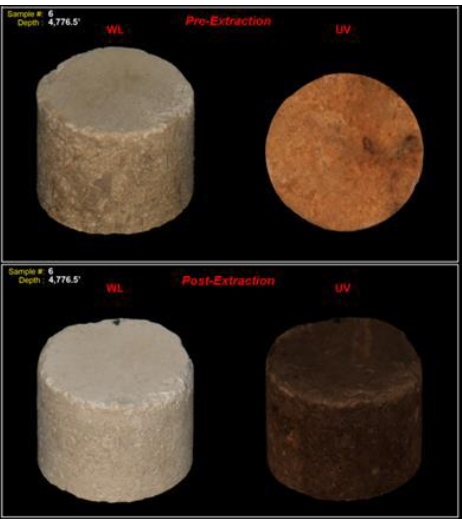
Post-Well Studies – Dunquin North: Rudist Floatstone



Evidence of predicted rudist bivalve colonisation was found.....

Post-Well Studies – Dunquin North: Rotary Sidewall Cores

UPPER ZONE



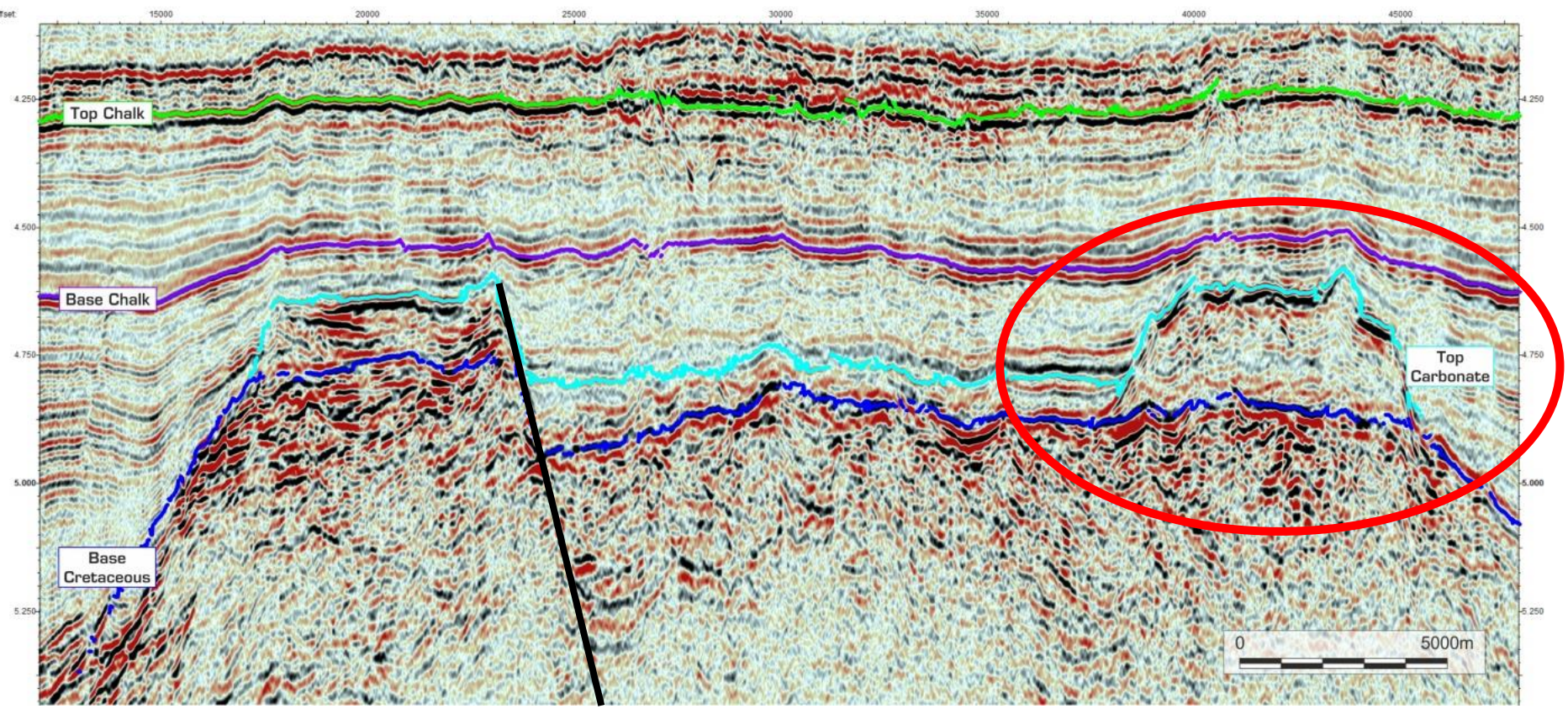
LOWER ZONE

Significant residual oil saturation (up to 50%) in Upper Zone.....

Summary

- Pre-drill modelling of the **Dunquin North** carbonate build-up was successful:
 - Seismically-derived morphologies correctly predicted Environment of Deposition (EOD) and were consistent with modelled regional paleo-environmental studies;
 - Seismic reflection interval velocity analysis correctly predicted porosity;
 - Mismatch between depth and velocity predictions attributed to porosity preservation due to early hydrocarbon emplacement.
- Working petroleum system has been demonstrated:
 - Significant residual oil column discovered in massive porous over-pressured Lower Cretaceous carbonate reservoir interval;
 - Breaching of the Dunquin North accumulation is probably evidenced by the presence of significant chimneys over that prospect.
- Remaining work now focused on material **Dunquin South** prospect
 - MC3D seismic data acquired over the acreage during 2017

DUNQUIN SOUTH.....?



THANK YOU...