

Devex Conference

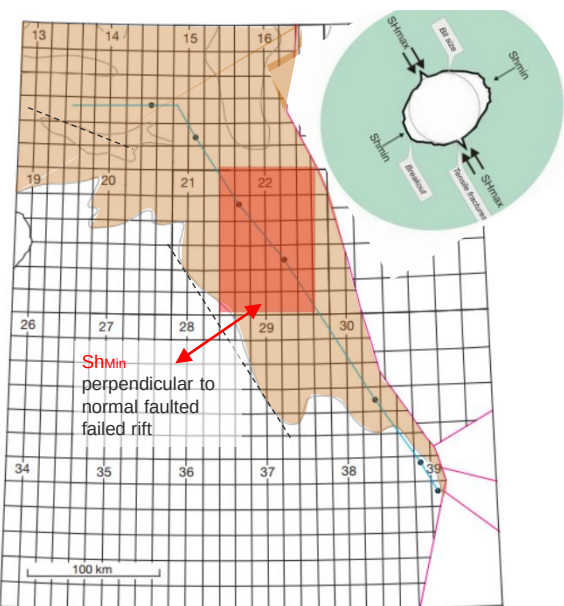
P&J Live Aberdeen 20-21 May 2025 - SPE Aberdeen section-

A simple Tertiary regional geological model to help geopressure assessment in Quad 22 and adjacent areas.

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Thanks to our JV partners: Ithaca Energy (*Montrose-Shaw-Cayley-Arbroath*) and Dana Petroleum (*Claymore-Scapa*)



Criteria	Sandy end member	Shaly end member
Lithology	Sandstone	Claystone
Deposition	Sediment dewatering by sands	Rapidly dumped sediment
Geothermal Gradient	1.7 deg F /100ft -low	2.9 deg F/100ft -high
Start oil window	5120ft (140 deg F)	3000ft (140 deg F)
Shales	Dewatered	Un-dewatered
Shales	Bound water released	Bound water locked in
Shales	Normally pressured	Abnormally pressured
Shales	Hydrostatic	Overpressured
Shallow gas	Low risk - leaky	High risk- seals
Basin position	Edge of basin/graben	Depocentre - graben centre
Sand bodies	Extensive -deterministic	Isolated - stochastic
Gas locked in annulus	No - it leaks	Yes - within a tunnel (wellbore)
Casing burst risk	Low	High - trapped annular pressures
Shales	Interbedded	Thick monotonous pile
Stability	Stable with mud ~10ppg	Unstable - mud required >13 ppg
Well control	Unlikely to kick - leaky	Can kick - isolated perm stringers
Risk	Low operational risk	High operational risk
Stuck pipe risk	Lower	Higher (mud weight >13ppg)
Annular pressures	Not expected	To be expected

Indicators if mud weight not high enough	
Geological ↑	Rising gas
	Splintery cavings
	Connection gas
	Pumps off gas
	Swab gas
	Positive drilling break
	Wellbore instability - pack-off
	Hole cleaning issues, stuck-pipe
	Influx-kicks (if isolated permeable sands)
	Casing sticking whilst running in hole
Pack-off during cement job	

Operational	Key Success Factors
	Wellbore stability studies in planning phase
	Management of ECDs during drill (PWD sub)
	Good hole cleaning with current mud weight
	Knowledge/experience/science/engineering Communication - full well/rig team

Increase in geothermal gradient – and temperatures – thick shales act as good insulator. No circulation of pore waters. Heat trapped from beneath within the failed Central North Sea graben (Moho far closer mid rift)

Indicators of Overpressures- from LWD logs	
Sed	Decreasing resistivity trend in shales
	Increasing sonic transit time in shales
	Declining density trend in shales
	LWD-pressures high in sands
	Increasing neutron porosity

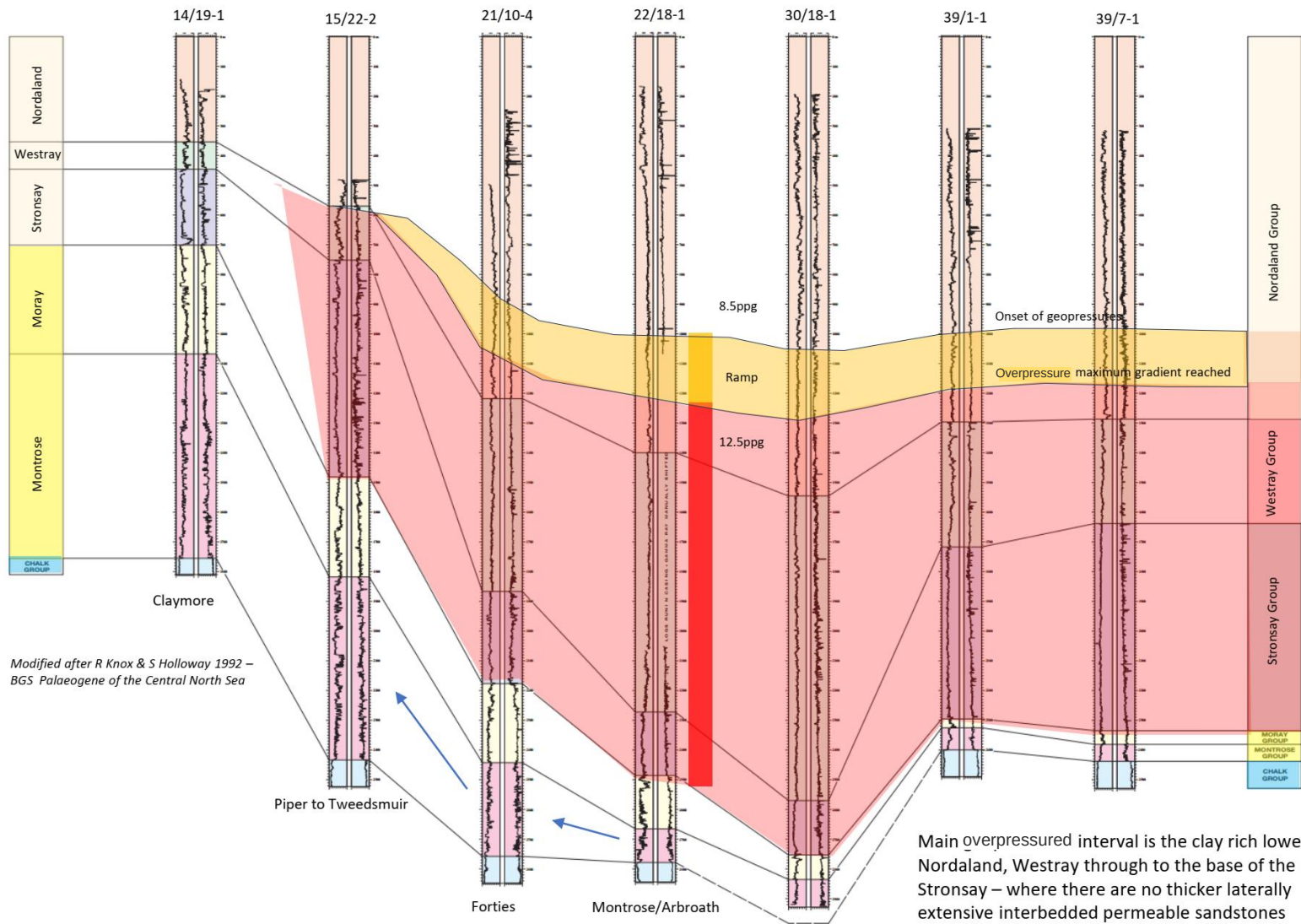
Benefits of Accurate Prediction
Safe operating environment
Stable wellbore - no cavings/pack-off
No kicks/losses - well control events

Tilted OWCs more common
Medium-low permeability sands
Pressure gradient - dewatering
Medium-heavy oil

Example- Montrose in original state

Central North Sea Well Logs and stratigraphy

Higher overpressure drilling risk - when drilling through full shale sequence with thin-isolated sands – non dewatered sands (e.g. Quad 22)



Modified after R Knox & S Holloway 1992 – BGS Palaeogene of the Central North Sea

Main overpressured interval is the clay rich lowest Nordland, Westray through to the base of the Stronsay – where there are no thicker laterally extensive interbedded permeable sandstones

