

# SEG/EAGE Workshop on The Deliberate Search for Stratigraphic Traps: Has It Come of Age?

## 7-9 December 2021 | Virtual Workshop

**VIRTUAL WORKSHOP**

SEG/EAGE WORKSHOP ON "THE DELIBERATE SEARCH FOR STRATIGRAPHIC TRAPS: HAS IT COME OF AGE?"

7-9 DECEMBER 2021

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**WELCOME TO THE SEG WORKSHOP:**  
SEG/EAGE WORKSHOP ON THE DELIBERATE SEARCH FOR STRATIGRAPHIC TRAPS: HAS IT COME OF AGE?

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Opening Session

Stan Stanbrook (Conference Chair)  
Sandeep Kumar Chandola (Conference Chair)  
Ian Longley (Opening Speaker)  
Ravi Mody (Keynote Address)

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PROGRAMME (INITIAL)

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Session 1: Regional Perspectives

Brianne Almyre (Session Chair)  
Kelly Powell (Session Chair)  
Stan Stanbrook (Session Chair)  
Bryan Crain (Keynote Speaker)  
Stanley Wharton (Speaker)  
Satevirte Nayah (Speaker)

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Session 2: Case Studies

Mark Hales (Session Chair)  
Gargi Sen (Session Chair)  
Duncan Barr (Speaker)  
Sharon Kier (Speaker)  
Amin Mowlaei (Speaker)  
Peter O'Mara (Speaker)

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Session 2: Case Studies

The Itanagar Field, successful appraisal and development of a complex stratigraphic trap

Peter O'Mara

Study area: Itanagar Field, northern of Aberdeen UKCS and southeast of the giant Britannia Field.

- Various technologies helped to improve the clarity of trap geometry, connectivity of the key reservoir units and the differential depletion of the sands in the reservoir. This includes wide-area VSE, GRT processing of the seismic that generated dual azimuth pre-CDM volume and inversion, and stratigraphic studies of the sands.
- Regional study led to better understanding of the sediment facies, presence of unconformities and identification of multiple stratigraphic traps with subtle differences between them, learning that such areas is unique
- Detailed mapping done within ongoing packages to determine termination style
- The remaining led to a series of new static and dynamic models and the first production around a month ago shows initial production rates very similar to the estimate.

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Session 2: Case Studies

Developing Near Field Stratigraphic Trap in Matured Producing Field

Abul Ahsanul Mohi and Sharar Akbar Syam

Study area: a matured field in Malay Basin and the identified projects are within Lower Miocene Group, characterized by complex fluvio-deltaic environment

- Integrated study helped to delineate the stratigraphic elements namely pinchout and facies change. These include using improved seismic, imaging, AVG and DFM analysis, regional and local stratigraphic knowledge. Interesting finding of baffling potential in poor quality facies (shale-filled channel, muddy intertidal/bayou bay)
- Leveraging wells with high probability of success to test near field traps when in a development scenario
- Improved geological understanding from reprocessed seismic assisted in identifying targeted development projects which encountered stable hydrocarbon volume

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Session 3: Exploration Effort and Risking Best Practice

Kelly Powell (Session Chair)  
Zhongjie Gao (Session Chair)  
Stan Stanbrook (Session Chair)  
John Dobson (Speaker)  
Bala Karanjit (Speaker)  
Graham Bagley (Keynote Speaker)

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Session 3: Exploration Effort and Risking Best Practice

Stratigraphic Trap Exploration since 2010

Graham Bagley

- Exploration success for classic stratigraphic traps has improved
- Commercial success looks quite robust compared with other trap types
- Lower slope appears to be a sweet spot. Same message as in session 1 regional perspective.
- Success similar for both graded slope and ponded slope but volumes in graded slope dominated compared to ponded

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Session 3: Exploration Effort and Risking Best Practice

Migration and Charge Risk for Stratigraphic Traps

Zhongjie Gao

- Significant lateral migration distances to reach stratigraphic traps
- Vertical migration works where there is an underlying structure which focused charge but it then breached
- Source rock for both graded slope and ponded slope but volumes in graded slope dominated compared to ponded
- Pore throat entry pressures related to porosity remain the determining factor for seal effectiveness NGD thickness

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Session 4: Addressing Trap Definition Challenges

Rajal Anshori (Session Chair)  
Naveen Singh (Session Chair)  
Henry Posamentier (Keynote Speaker)  
Agnus Ferguson (Speaker)  
Lawrence Amy (Speaker)  
Mikha Niyati (Speaker)  
Alekj Thompson (Speaker)

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Session 4: Addressing Trap Definition Challenges

Thoughts on stratigraphic traps

Henry Posamentier

- Intimate knowledge of depositional systems is required to leverage context
- Data quality must be high & exploring for stratigraphic traps in a frontier setting is dangerous
- Stratigraphic traps are rarely purely stratigraphic traps. Often, they are combinations of any considered stratigraphic with a "structural twist"
- Other stratigraphic traps with a sub 20% POC but with large upside are not drilled/preferred by management. Getting management to look beyond this paradigm is still challenging. Important to re-emphasize the need to integrate high quality data to support assessment and to allow for sufficient time to drive deeper into the details of how the trap works

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Session 4: Addressing Trap Definition Challenges

Formation of upslope stratigraphic traps in turbidite systems: insights from producing fields, modern sea floor systems and sediment transport models

Lawrence Amy

- Steeve fine-grained systems, or distal systems offer better trap potential
- Coarser grade systems less likely to have upslope pinch-out
- Avoid not acquiring seismic data over the up-dip part of your system, makes risking near impossible

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Session 5: Innovative Workflows and Emerging Trends

Gillian Apps (Session Chair)  
Dawn Hildt (Session Chair)  
Stan Stanbrook (Session Chair)  
Alicia Burns (Speaker)  
Simon Shaddad (Speaker)  
Carlos Andres (Speaker)  
Wael Beh Habel (Speaker)  
Donald Christie (Speaker)

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Session 5: Innovative Workflows and Emerging Trends

Stratigraphic Traps for Carbon Storage: Rethinking Risk and Success

Alicia Burns

- Carbon Storage is more forgiving than hydrocarbon exploration; flawed stratigraphic trap work & reservoir heterogeneity works in your favour
- There are advantages to injecting CO2 down into often better thicker reservoirs, taking advantage of migration losses in what can be increasingly heterogeneous lithologies (e.g. shale)
- Reservoir heterogeneity slows CO2 migration and leads to a more even sweep of CO2, even with quite small differences in permeability (in cross-bedded conditions, for example)
- CO2 migration can be slowed down considerably (order of thousands of years); the ultimate trap may not be critical
- While accepting that the regulator will need to know the operator understands how injected CO2 moves through the host reservoir. Also pointed out it is more important to monitor these regions where you do not expect the CO2 to go, to ensure there is no leakage in unexpected areas.

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Session 5: Innovative Workflows and Emerging Trends

Stratigraphic forward modeling to seismic forward modeling: An innovative approach in characterizing carbonate reservoirs

Wael Beh Habel

- Process-based forward stratigraphic modeling, incorporating a large range of processes controlling carbonate growth and reseed-mediated carbonate facies
- Models include rule-based diagenetic modification of reservoir
- Synthetic seismic model generated from reinterpreted geologically modeled, with full range of elastic properties.
- Model does not yet integrate geochemical data, e.g. fracture and faults

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Session 5: Innovative Workflows and Emerging Trends

Nested Models – the new basin modeling standard for stratigraphic traps?

Colin Archer

- Nested high-resolution models with larger simulation models allow the user to vary properties smoothly, particularly good for modeling HC migration into stratigraphic traps.
- Nested models allow quick refinement of models to address interpretation uncertainty; enabling faster cycle time to test multiple scenarios
- Modeling software can incorporate geochemical complexity.
- Nested modeling should be very useful for carbon storage as well as for hydrocarbon exploration.

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Session 5: Innovative Workflows and Emerging Trends

Forward Stratigraphic Modelling with Onlap-2D for Reservoir Prediction: Offshore Surobo Basin, Mexico

Daniel Christie

- Geometric modelling of clastic deposition, active and passive, with real structure growth, in a complex deepwater setting
- Model input does not require more information than is available to most explorers, and the approach is suitable for areas with low seismic resolution and few wells
- The model is fast to run, allowing user to investigate multiple models and a given prospect
- So far, Onlap-2D has been applied to minibasins in compression and salt tectonic settings. Daniel is seeking to apply the software in other tectonic regimes, like rift and post-rift settings

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Session 6: Geophysical Approaches

Predicting Carbonate Geomorphology Through Seismic and Velocity Driven Data of an Amalgamated or not? Carbonate Prospect in Central Luconia

Daniel Christie

- Recent detailed seismic reprocessing revealed a separate, unmetamorphosed built-up/intracave with bigger platform.
- Hypothesis of amalgamated built-up remains isolated built-up.
- Revised water to talus while talus is in hydraulic communication with the platform indicating potential of clastic sediments surrounding the talus
- Seismic velocities are a key piece of evidence to support the hypothesis of a tight top and lateral(?) seal for prospect x

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Session 6: Geophysical Approaches

Ferman Kurbanov (Session Chair)  
Jan Korkhambert (Session Chair)  
Daniel Hamo (Speaker)  
Joseph Kelly (Speaker)  
Alekj Thompson (Speaker)  
Adi Widjanto (Speaker)  
Mark Samra (Speaker)

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Session 6: Geophysical Approaches

Resolution enabling the exploration and development of stratigraphic traps

Joseph Kelly

- Talk on data confidence – resolution and data fidelity factors that determine bandwidth extension, subjective decision making
- 3D seismic has been a game changer for development of giant stratigraphic traps but not so much in the exploration; giant discoveries largely made on 2D data
- Increasing resolution remains a challenging task and requires further research
- Interpreter might decide on frequency boost for higher visual resolution at the expense of noise boosting
- Higher resolution required to place wells in complex depositional systems such as the Guyana fields
- Many remaining opportunities to improve seismic data acquisition and processing

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Session 6: Geophysical Approaches

Removing lithology to show the fluids through seismic inversion

Mark Samra

- Bulk modulus better fluid indicator in relationships
- Not straightforward to be complex lithologies and imperfect seismic data, e.g., noise
- Example of successful fluid indication from bulk modulus

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Closing Session

Gargi Sen (Session Chair)  
Stan Stanbrook (Conference Chair)  
Gargi Sen (Session Chair)  
Ian Sayers (Session Chair)

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Technical Insights\*

- Stanley Wharton / Peter O'Mara – the need for "surgical mapping"
- Mark Thompson – Regional to prospect scale workflow overview (Regional Setting, Trap Domain Map, DHI – in that order; JALSA, I highly recommend their class!)
- Henry Posamentier – staked pay can help self stratigraphic traps
- Henry Posamentier – "The risk chess" in stratigraphic traps between mature and frontier areas
- Duncan Barr – taking conventional core can overturn depositional interpretation and thus the whole trap concept
- Henry Posamentier – Data quality must be high & exploring for stratigraphic traps in a frontier setting is dangerous!
- John Dalton – If you have pay, even a small interval (especially if tight), on Map, DHI – in that order; JALSA, I highly recommend their class!

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Some Philosophical Points\*

- Lawrence Amy – avoid not acquiring seismic data over the up-dip part of your systems, makes risking near impossible
- Henry Posamentier – Intimate knowledge of depositional systems is required to leverage context
- Bryan Crain – "granularity" (non-binary view) of trapping elements in slope systems (8-point check-list)
- Duncan Barr – That geoscientists must be allowed to change their minds
- Henry Posamentier & Mike Moyal – Informing / educating the decision makers is part of the journey

Thank you

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Don't forget to complete the virtual workshop Survey! The link will be shared with the attendees after the workshop

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