SEAPEX Talk

SINGAPORE –
Friday, 25 June 2021

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United Kingdom

Title - Reservoir Characterization of Deep Marine Sediments, Offshore Northern Borneo

Abstract

The Northwest Borneo margin and the NW Borneo Trough are related to the opening of the South China Sea. The proto-South China Sea, was subducted beneath the Sunda Shelf, during the Late Cretaceous times. The cessation of subduction occurred in the Miocene, where large blocks of continental shelf blocked the Subduction trench. Subsequently causing collision between the leading edge of the South China Sea continental realm with the Crocker-Rajang accretionary margin of Northwest Borneo. The uplift and erosion of this accretionary margin provided abundant sediment supply to form the Baram Delta. Both modern day and ancient sediments deposited in deep-marine settings, Offshore Brunei, are characterized by large scale submarine landslides.The deposits of the landslides are known as Mass transport complexes (MTC) or Mass Transport Deposits (MTD's) and provide valuable information on sediment dispersal patterns, paleoslope and sedimentary history. This information is particular significant when reservoir sands are devoid of any indication of paleocurrent direction and seismic data quality is poor.

The modern day shelf is 50-70km wide and characterized by the Baram river and delta system connected via a canyon to the NW Borneo Trough. A steep sided escarpment rises 1km from the basin floor separating the shelf margin from the trough. The seafloor morphology is defined by elongate mini basins, parallel to the coastline separated by shale-cored ridges. Observed on the modern basin floor are Giant Submarine landslides. The size of these slides (volume 1200km3, covering an area 5300 km2 with a thickness of approx 240m). These features are commonly observed in the subsurface, and are thought to be a result of the tectonically active margin and the large sediment supply from the Baram Delta.

Miocene sediments appear dominated by quiescent sedimentation with medium thick bodies of conformable sedimentation, with consistent structural dip, interspersed with sheet sands and sporadic thin debris flows which dominate the sedimentary facies. However, interspersed in this uniform sedimentary environment, is massive structural failure, initially slides and slumps, debris flows, followed by post depositional creep, similar to the modern-day seabed. Related to these deposits are thick, massive sands, probably deposited as localized proximal fans.

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Exploration Sedimentologist/Geo-Petrophysicist for Oil/Gas and Geothermal: adept at delivering geological play evaluation for exploration, appraisal & development projects for oil, gas and Geothermal Fields in a variety of basin settings. Key strengths include clastic & carbonate sedimentology (marine environments incl. deep-water (turbidites) & shallow-water (coastal plain) and fractured carbonates and basement. I am experienced in borehole image analysis & openhole log data interpretation including NMR, Sonic and ECS, in order to produce facies and sedimentological models, as well as fracture models. I am proficient in Interactive Petrophysics (IP), Techlog & Petrel software. I have a vast experience in wellsite wireline logging support as well as project planning & management. Equipped with excellent technical & observational skills and good commercial acumen.

KEY ACHIEVEMENTS

- Interpreted and Project managed the delivery of a Khuff Characterisation study in North Field (Qatar) incorporating data from petrophysical, FMI log, PLT, dynamic (MDTs), well completion, stimulation & drilling to determine factors affecting wellbore productivity.
- Managed the delivery of Dukhan Facies Study in Qatar for Qatar Petroleum to improve understanding of rock typing, porosity & permeability in Arab-D reservoir; results were compared with historical data and highlighted increased resources for Qatar Petroleum.
- Managed and Interpreted a Fracture study for Bul-Hanine Field, Off shore Qatar utilizing images, core, NMR and PLT
- Analysis of the Sudair Formation, Qatar , locating water cuts
- Managed and Interpreted a Microporosity study in the Uwainet Formation Qatar using core, images and NMR
- DCS Geology Domain Lead in Qatar & Yemen. Interpreting all LWD Image logs acquired in Qatar
- Processed and interpreted numerous Fractured Image Logs for Granite Basins in Yemen, Malaysia and the Philippines,

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EMPLOYMENT EXPERIENCE

GEODE-ENERGY LTD **JAN 2015 - PRESENT**

Borehole image interpretation including, processing, dip picking, facies and facies association analysis, including depositional environment. In addition, image processing for fracture analysis, including fracture density, aperture and orientation. Full petrophysics integration is incorporated into this holistic workflow.

Key Client- SDX Energy: Facies modelling the Miocene, Pleistocene sediments onshore Nile Delta, Egypt

SCHLUMBERGER **JAN 1998 – DEC 2014**

Principal Domain Geologist, Wireline **Jan 2012 – Dec 2014**

Malaysia, Brunei & the Philippines

- Interpreted and built sedimentological models for various Fields in Malaysia and Brunei, particularly shallow marine deltaic and turbidite plays for Petronas, Shell, Murphy, and Lundin to name a few.
- Lead for operational and technical support for Wireline operations in Malaysia, Brunei and the Philippines and for key clients (including Pertonas, Lundin, Murphy, Talisman & Shell).
- Provided support regarding geological tools, including Sidewall Core, FMI & QGeo; supported operational geologists whilst logging and geoscientists during interpretation. Ensured high quality standards were achieved in line with industry best practices. Reviewed, assessed and evaluated technical studies.
- Managed communications with stakeholders to ensure the projects were seamlessly delivered.
- Organized, managed, taught Techlog Training and Borehole Image Analysis in the Region

Consultancy Services & Business Development Manager, Qatar **May 2010 – Dec 2011**

- Led a team of 7 conducting detailed fracture studies and geological modelling for carbonates in the Qatar region. Played a key role from identifying a business opportunity through to producing technical/commercial proposal and delivering services.
- Carried out a detailed sedimentary studies on microporosity, bioturbation and facies identification on North Field, Dukhan and Bul-Hanine Fields and presented results to client stakeholders as required. Led a team of geologists, petrophysicists, reservoir engineers & production engineers.

DCS Geology Domain Lead, Qatar & Yemen **Jan 2009 – May 2010**

- Managed a team of 4 geologists conducting single well analysis of borehole images acquired in Qatar and Yemen on behalf of Total.
- Ensured compliance with Schlumberger's operational and technical standards and

timely delivery of data to support interpretation and well location recommendations.
- Mentored team members that were less experienced.
- Oragnixed, managed and taught NeXt Training Courses in the region

Consultant Project Manager, Beijing, China **Apr 2008 – Dec 2008**

- Selected to deliver 2 concurrent projects in China, including the build of a Petrel static and dynamic model in complex volcaniclastic and Bohai Bay well placement project (based on seismic inversion results). Led a team of 20.

DCS Business Development Manager, Egypt, Sudan & Syria **Nov 2006 – Apr 2008**

- Responded to tenders from Sudan, Syria & Egypt; wrote technical & commercial proposals and presented technical solutions to potential clients; provided financials. Secured year-on-year growth.
- Acted as the NeXT Training Manager; coordinated petroleum training courses for clients in the region.

DCS Geology Team Leader, Egypt, Sudan & Syria **Aug 2004 – Nov 2006**

- Led a team of geologists conducting single well analysis of borehole images acquired in Egypt, Sudan and Syria.

Interpretation & Development Geologist & Domain Champion **Jan 2004 – Aug 2004**

- Provided operational and technical support for Wireline Geological Tools for clients in Ireland, UK & Scandinavia.

Interpretation & Development Geologist & Team Lead, Alaska, US **Feb 2001 – Dec 2003**

- Provided operational support for Wireline and D&M Geological acquisition; conducted interpretations of the image logs and integration with petrophysical and production data.

Geologist, Field Development Plan, Bayan Field, Sarawak Basin **Jul 2000 – Feb 2001**

- Lead Geologist on FDP for Petronas and built a geological model to reassess an aging field.

Geologist, DCS **Jan 1998 – Jul 2000**

- Conducted geological interpretation of image logs for SE Asia region. Worked in Malaysia, Burma, Borneo, Thailand, Brunei, Vietnam & Cambodia as required.

EARLIER CAREER

Geology Lecturer, University of Malaysia Sarawak (UNIMAS) **Sep 1995 – Dec 1998**

EDUCATION

M.Sc. Cardiff University 2017. Sustainable Energy and the Environment

Ph.D. in Geology, University of Southampton, UK, 1995. Supervisor: Prof D.A.V. Stow
Thesis: Turbidites: The Significance of Shale Clasts in Deep Water Massive Sands
B.Sc. in Earth Sciences,. University of Liverpool, UK, 1991 Supervisor: Prof Trevor Elliot
Thesis: Facies Analysis of the Valensole Fm, S. France

CONFERENCES POSTERS & PRESENTATIONS

15th-17th Dec 1993: British Sedimentological Research Group, Birmingham, UK
A preliminary classification for shale clasts within deep water, structureless sandstones

12th-13th Jan, 1995: Workshop on Experimental and Theoretical studies of Processes in Turbidity Currents, Liverpool, U.K.
'Shale clasts within deepwater sediments and experiments with low density outsized clasts with high density concentration flows'

22nd-25th June, 1997: Tectonics, Stratigraphy & Petroleum Systems of Borneo, Brunei
'Facies Analysis of the Miocene Plateau Sandstones at Bako National Park, Sarawak East Malaysia'

17th-19th Aug, 1998: GeoSea, Kuala-Lumpur
'Evidence to support near-steady turbulent flows in sandy alluvial system: the Miocene Plateau Formation, Bako National Park, Sarawak'

22nd-23rd Dec, 2000: GeoSea, Kuala-Lumpur
'Stratigraphy of the Sarawak Basin - Balai-1'

18th-23rd May, 2002: AAPG/SPE Regional Conference, Anchorage, Alaska
The Geological Application of Acoustic Images in Homogenous Clastic Sediments: Examples from the Tertiary Hemlock Formation, Cook Inlet, Alaska'

28th-29th Apr, 2003: Submarine Slope Systems, Liverpool, U.K.
The Subtleties and Significance of thin bed analysis in Slope Fan Settings: Examples from the Late Miocene Mt. Messenger Formation, New Zealand

20th April 2004 SPE Bergen
The use of borehole shape analysis from acoustic images for optimal placement of open hole packers

16th-18th May 2005: Imaging the Future, Cairo, Egypt
The Sapphire Field: An integrated approach to Reservoir Characterization

1st-2nd April, 2006: Subsurface Geology of the Nile Delta: Basin Analysis and Petroleum Systems
Borehole Image Analysis Demonstration.

10th-11th Aug 2010, **Sanaa Yemen** Reservoir Characterization using Borehole Images, Tight Gas Workshop, SAFER Oil Company, Yemen

28th September, 2012: SEAPEX, Manila, Philippines Understanding Carbonates – the complexities of rock typing.

12th-14th March, 2013 AAPG Asia Pacific Deepwater Plays: Exploration and Production, Brunei Darussalam. Deep Marine Deformation Dip Patterns, Offshore Brunei – Thoughts and Discussion

18th-19th March, 2013: PGCE, Kuala-Lumpur, Malaysia Subsubsurface Facies Analysis and Reservoir Characterization of the Late Oligocene Penyu Formation, Shallow Marginal Marine

to Low Energy Deltaic, Penyu Basin, South China Sea, Malaysia.

17th-18th February 2014: EAGE/FESM Joint Regional Conference Petrophysics meets Geoscience Sand Body Characterization in Tidal Marine Settings – Examples from the Penyu Basin

3rd-5th November 2014: EAGE Offshore Carbonate Gas Field E&P in Asia and the Middle East: Challenges, Technologies and Economics The Complexity of Carbonate Rock Typing: Comparisons between the Middle East and Malaysia

10th-12th December 2014: IPTC International Petroleum Technology Conference Integrating High Resolution Multi-Well Image Logs to Improve Geological Reservoir Characterization and Sequence Stratigraphy

24th February 2017: Herriot-Watt, Institute of Petroleum Engineering guest speaker The Complexity of Carbonate Rock Typing

23rd March 2017: AAPG Manchester Student Chapter The Complexity of Carbonate Rock Typing

21st-24th August, 2017: ICAE Cardiff The Feasibility of Microhydro Power in South Glamorgan, Wales

PUBLICATIONS

Braakenburg, N.E., Stow, D.A.V., Broquet, P., Duee, G., Faugeres, J.C. & Johansson, M., 1992: The Field Guide for the Arthur Holmes European Research Conference on Deep Water Massive Sands, Sicily 23rd -28th September, 1992.

Stow, D.A.V., Braakenburg, N.E. & Johansson, M., 1994: The Atlas of Deep Water Massive Sands. (In-House Publication for a Consortium of Oil Companies)

Johansson, M, Braakenburg, N.E., Stow D.A.V. & Faugeres, J.C., 1998: Deep-Water Massive Sands: Facies, Processes and Channel Geometry in the Numidian Flysch, Sicily. Sedimentology Special Publications, V.115, pp. 233-265.

Johansson, M., 1998: Facies Analysis of the Plateau Sandstones (Eocene to early Miocene), Bako National Park, Sarawak, Malaysia. Journal of Asian Earth Sciences, V.170, pp. 233-246.

Johansson, M., 2000: Prospecting for Clay in the Jungles of Borneo: The Belaga Formation, Nanga Sumpa, Batang Ai, Sarawak, Geological Society Malaysia.

Stow, D.A.V. & Johansson, M., 2000: Deep-Water Massive Sands: Nature, Origin and Hydrocarbon Implications. Marine & Petroleum Geology. V.17, pp. 145-174.

Johansson, M & Saltmarsh, A, 2002: The geological application of acoustic images in homogenous clastic sediments; examples from the Tertiary Hemlock Formation, Cook Inlet, Alaska. SPE. No 77995.

Johansson, M., 2005: High Resolution Image Analysis in a Slope Fan Setting; examples from the Late Miocene, Mt. Messenger Formation, New Zealand. From: Hodgson, D.M. & Flint, S.S. (eds), In: Submarine Slope Systems: Processes and Products. Geological Society, London, Special Publications, 244, pp. 75-88.

Stow, D.A.V. , Riahi S. , Soussi, M., Fildes, C., Patel, U., Marsh, S., Johansson, M., 2009: Reservoir Characterization of Deepwater Massive Sandstones – Case Studies from the Numidian Flysch and Mediterranean. : Tunis 2009 - 4th North African Mediterranean

Petroleum and Geosciences Conference and Exhibition.

Johansson, M. 2012: Carbonates - The Complexities of Rock Typing. Philippine Resources - Mining, Petroleum and Energy Journal, Issue 4, pp. 52-56

Bahadidah, T, Dashti, R, Ismal, M.H., Nair, N. Marca, S. Abd Malek, Yunan, M & Johansson, M, 2014: Integrating High-Resolution Multi-Well Image Logs to Improve Geological Reservoir Characterisation and Sequence Stratigraphy, IPTC-18209-MS

Johansson, M. & T. O'Doherty, 2017; Feasibility of MicroHydro Power is South Glamorgan, Wales. Journal of Energy. Energy Procedia 142 (309-214)