



ORAL PRESENTATION

Day 2: 8th March 2023

Session 8: FUTURE EXPLORATION

Co-Chair: Nick Comrie Smith, Harbour Energy

Co-Chair: Arturo Morado, Consultant

15:50	Agung Blocks: Exploring Deepwater East Java	Nurfiana Rachmawati	bp
16:15	Building a CBM Business in the Heart of Asia - 4 Years of Drilling in the Gobi Desert, Mongolia	Greg Channon	Elixir
16:40	SE Asian Basins on a Shoestring: A Look Underneath at Basin Formation around the South China Sea, some Potential Play Fairways and a Wistful Comparison to Atlantic Margin Super-plays	Bill Dickson	DIG
17:05	Greater SE Asian Frontier Exploration Potential – 10 Untested Billion Barrel Potential Opportunities	Ian Longley	GIS-pax Pty Ltd



ORAL PRESENTATION

Agung Blocks: Exploring Deepwater East Java

Nurfiana Rachmawati¹, Albertus Pradipta¹, Leonardus Tjahjadi¹

¹bp

nurfiana.rachmawati@se1.bp.com

For more than 55 years, bp has been an energy partner to Indonesia and continues to be the largest investor providing integrated energy solutions to the country. Resilient hydrocarbons is one of the three pillars underpinning bp strategy. The award of Agung I and II blocks demonstrates bp commitment to continuing to explore for hydrocarbons in high value areas.

The area is defined as the offshore deep-water NE Java and North Bali Basin. Both blocks are an under- explored part of a prolific basin in Indonesia in which more than three Bnboe oil and gas has been discovered to date. Given the sparse 2D seismic lines over the area and lack of wells drilled, this area is attractive for further exploration.

Though the deep-water offshore is largely under explored, onshore and shallow water area have numbers of carbonates and clastic reservoir discoveries, such as Eocene clastics at Pagerungan L 46- 1, Eocene carbonates at JS53 and West Kangean, Oligo-Miocene carbonates at Banyu Urip, Sukowati, BD, and Pliocene Terang-Sirasun.

A significant undrilled rock volume could offer multi Tcf YTF resources. A series of prospects and leads targeting Oligocene carbonate reservoir sourced by Palaeocene-Eocene syn-rift shale have been identified using current data. An exploration program of acquiring new seismic is planned to better define the targets.

SPEAKER BIOGRAPHY

Nurfiana has been in the industry for 15 years, starting career as Borehole Seismic Specialist with Schlumberger for almost four years then switched career with bp until present. With bp, Nurfiana has been exposed to wide skillset and knowledge from exploration, appraisal, development in wide variety of subsurface setting, such as many basins in Indonesia, Norway, Northwest Shelf Australia, and Caspian Sea. Holding a bachelor's degree of Geophysicist from Gadjah Mada University, Nurfiana is passionate in developing herself and others by coaching younger staffs and giving short seminar to university. Outside work, Nurfiana enjoys reading and singing.



ORAL PRESENTATION

Building a CBM Business in the Heart of Asia - 4 Years of Drilling in the Gobi Desert, Mongolia

Greg Channon¹

¹ *Elixir Energy Limited*

gregchannon@gmail.com

ASX-listed Elixir Energy has been exploring for Coal Bed Methane (CBM) in the South Gobi Desert of Mongolia since 2019. We have acquired more than 1,170 km of 2D seismic and drilled nearly 40 wells. Our first intersection of gas saturated coal was at Nomgon-1, where we intersected 72m of coal with up to 10m³/t gas. Injectivity Fall Off Testing (IFOT) at Nomgon-2 showed these coals have permeabilities of up to 90mD. A production pilot test of the Nomgon resource is now flowing at rates of greater than 100,000 cubic feet per day.

Elixir is Mongolia's first and foremost CBM company, but we are pleased to have been joined by other ASX companies in recent years. This paper outlines the techniques used in the exploration and pilot program, and discusses the results, some of which have redefined the geology of the Gobi Basin and enabled the Operator to fast-track the Pilot Program.

SPEAKER BIOGRAPHY

Greg Channon is a geologist with 35 years of global oil and gas experience in a great variety of technical and leadership roles. Currently, his primary role is Chief Geoscientist for Elixir Energy, where he is overseeing technical operations in Mongolia and Queensland. He is also undertaking consulting roles in Alaska and Canada and is a Non-Executive Director of Xstate Resources Limited.



ORAL PRESENTATION

SE Asian Basins on a Shoestring: A Look Underneath at Basin Formation around the South China Sea, some Potential Play Fairways and a Wistful Comparison to Atlantic Margin Super-plays

Bill Dickson¹

¹ DIGs (*Dickson International Geosciences*)

billd@digsggeo.com

Introduction

This talk pulls threads from a SEAPEX Press series that began with issue One Hundred, in mid-2020, as we updated a non-exclusive regional evaluation from 2006. New and expanded framework data and global geoscience progress prompted revisions that yielded our articles. Referencing our continuing multi-disciplinary work on Atlantic margin basins yields illustrations of three giant deepwater plays (exploration for the deep-deep-pocketed). Considering the enabling geologic controls, we ask where across Southeast Asia such plays might sit and offer one example. For the bulk of today's audience, we quickly shift to inexpensive ways for defining sufficient potential to tie up and flip acreage. As we explore a concept, the key for us shallow-pocketed is in the words of Red Green: "imagination costs nothing!" My corollary is that plays can be partially defined on a shoestring, using methods we discuss. A perambulation from Beibuwan to Tu Chinh with a side-track to the Thai Gulf offers play ideas and how they can be defined (techniques and data) at levels from raw concept to money in the bank.

Bottoms Up: Crustal Controls on Basin Formation and Deformation

The key understanding of evolution of the north-western South China Sea basins hinges (literally) on the Song Hong/Yinggehai (SHY). Its eastern margin is the segmented trace of the combined Red River - Number 1 - East Vietnam Fault (RRN1EVF) as discussed in SEAPEX Press n106. The SHY basin formed as a crustal detachment slid from the south and west into the volume formed by the complex movements of this eastern boundary fault. Secondary structural features formed in response to these movements including a subtle roughly west-east trend within SHY that seems to control the distribution of Miocene fans within the basin.

Just south of SHY, the deepwater PKB (Phu Khanh Basin, including the Hoang Sa / Ly Son sub-basin to its northeast) formed by Oligo-Miocene rifting and post-rift thermal subsidence. However, its hydrocarbon potential is also related to the stresses that caused movements along the RRN1EVF. Activation of shear zones that offset the western Phu Khanh high provided pathways for sediments produced in response to uplift of onshore provenance regions.

A third aspect of crustal control springs from observing uplift and present-day offsets of the full distal sedimentary sequence on a PKB seismic line adjacent to oceanic crust. We attribute late volcanic activity (Hoang et al., 2020) as causing the uplift. It isn't compression-related as South China Sea oceanic spreading ceased about 10.5 Ma. We eliminate gravity gliding on a shallow intra-crustal detachment (Granath & Dickson, 2021) because the related updip extension would have been noted on shoreward lines.

Atlantic Margin Super-giant Plays as SEA Analogues

We illustrate deepwater passive-margin plays offshore Guyana-Suriname; Namibia-South Africa; and Senegal-Mauritania. Each derives from a) Restriction during source development and b) Provenance from an adjacent cratonic quartz factory. That is, distal regions on oceanic and transitional crust provided restricted reducing GDE giving rise to rich oil-prone A-C-T source. Adjacent long-lived cratons provided the needed sands to form high-porperm tanks which next were buried and sealed by fine-grained sediments.

In applications for SE Asia, we first a) examine trenches and edges of oceanic or transitional crust for evidence of restriction. Look for seismic signatures indicative of possible source. High-amplitude low-frequency parallel seismic reflectors are a clue; modern seismic yields better information from inversions and velocity analyses. Then b) we search for signatures of sand inputs (bird's feet; channel cut-and-fill; contourites) adjacent to quartz provenances. These conduits often align with basement trends (Christ et al., 2003) evident on potential fields imagery. Deepwater PKB passes the source and reservoir tests with examples provided.

What About the Play? Miocene Fans to the Rescue

Early-mid Miocene fans in SHY are sourced from the north, locating in semi-confined channel systems along the basin margin; their Hainan High provenance may be more feldspathic. Late Miocene fans in SHY are sourced from a Viet-Laos quartzose provenance to the west and southwest; deposition was at bathyal depths as for Tu Chinh-Vung May/North Sarawak. For outboard PKB, depths ranged to abyssal.

Deepwater Late Miocene fans in northern PKB and central Tu Chinh exhibit anomalous amplitudes consistent with low-impedance sands. Hoang et al. (2020) interpret these as lava flows but in Brazil's Sergipe basin, AVO signatures clearly separate lava flows/basalts (bright at all offsets) from Late Cretaceous sands (brightening with offset).

Summary

Using three examples from the South Atlantic margins, we illustrate how big plays can be defined more with good thinking than with expensive data (caveat: the real data expense will follow). We offer an example from deepwater Phu Khanh with sufficient spadework to define a working petroleum system. We also suggest potentially commercial fan plays in shallower waters in the adjacent Song Hong/Yinggehai and Tu Chinh-Vung May/North Sarawak basins. To quote Hot Chocolate, "Everyone's a winner baby!"

Acknowledgements: This paper draws heavily on work by the following three earth scientists:

- Mark Odegard who continues to scrape, curate and rework data into the sterling framework materials that undergird the SEATIGER and MARIMBA studies of DIGs.
- Jim Granath who provides expertise in structural geology and interpretation to his consulting clients including work on an exciting basin onshore northeastern Namibia.
- Janice Stringer, formerly Christ, is retired, now utilizing her geoscience expertise to build out a personal genealogy that currently exceeds 3000 (mostly dead) relatives.

References: Available on request from the author.

SPEAKER BIOGRAPHY

William (Bill) Dickson is the founder and VP-Technology for DIGs (Dickson International Geosciences) in Houston. He works principally in multi-disciplinary mode, building super-regional basin studies with a range of subject matter experts. His primary geographic focus on South Atlantic margin basins and a secondary focus on Southeast Asia build on decades of international and frontier exploration projects with IOCs and his consultancy. Since his first interpretations, he has involved gravity and magnetics data and, more recently, organic geochemistry, despite a limited understanding of the methods.

Bill is a member of AAPG, EAGE, GESGB (fka PESGB), SEAPEX, SEG, SPE and local societies in Houston. He has authored and contributed to papers on aspects of South Atlantic and SE Asian geology. He is a co-organizer of recent HGS-PESGB Africa conferences and serves on the board of AAPG's Datapages subsidiary.

Apart from geoscience-related activities, he is a long-time board member of OCWH, the Outreach Center of West Houston, supporting its tenants and their programs.



ORAL PRESENTATION

Greater SE Asian Frontier Exploration Potential – 15 Untested Billion Barrel Potential Opportunities

Ian Longley¹

¹ GIS-pax Pty Ltd

ian.longley@inet.net.au

A spatial lookback of global hydrocarbon exploration outside of onshore and shallow water North America since 2000 shows that ~85% of all discovered conventional hydrocarbon volumes were within or adjacent to areas of proven charge as at 1.1.2000 and only ~15% of discovered volumes were found in areas beyond these proven charge areas in areas typically classified by the E&P industry as “frontier”. This paper discusses these frontier areas in the greater SE Asia area.

The global conventional frontier hydrocarbon exploration effort over the post 1999 period has been focussed into the DW GOM, the Atlantic margins, onshore and east Africa and the eastern Mediterranean since these are the areas where the industry perceived there are large opportunities within areas with competitive fiscal regimes and many large discoveries have recently been made in all of these areas providing demonstrable proof of the efficacy of this strategy.

In contrast the greater SE Asian area (SE Asia plus PNG and the Australian NW Shelf) has seen limited investment in conventional frontier exploration drilling over this period with only 4 new frontier provinces discovered with this limited effort namely the DW PRMB Liwan-3-1-1, Offshore Myanmar Shwe, Bedout Sub-basin Dorado and the DW Andaman Timpan discovery areas and all of these have so far proven to be volumetrically limited by global standards and mainly gassy to date leading to the current industry perception that on a global scale this is an area of limited frontier exploration potential.

This presentation details fifteen real opportunities variously from Indonesia, Malaysia, Vietnam, NW Australia, Taiwan, Indian Andamans, the Philippines and South Korea which are untested frontier exploration areas with large/billion barrel potential which are known to the author. Many other opportunities exist so the opportunities presented should be considered only as an indicative subset of what likely exists within the region. Other material play extension and new complex traps in proven charge areas also exist within the region but they are not discussed in detail. The conclusion from this collection of opportunities is that many material conventional frontier exploration opportunities demonstrably do exist in the region and it's the lack of investment and drilling of these more risky opportunities that is the key issue not the absence of opportunities. The reasons for this are discussed and although some opportunities clearly face material technical, political and/or fiscal challenges the main challenge is simply the conservative mindset of most exploration teams in the area and the simple lack of awareness of the existence of these types of opportunities both within the exploration company search teams, many based in distant hemispheres, and within the various government NOC and regulator bureaucracies. These challenges can easily be remedied and future investment and drilling of these and other exciting opportunities should then follow.

SPEAKER BIOGRAPHY

Ian Longley is a regional petroleum geologist with 30 years of experience who has worked for Lasmco, Woodside, Shell and Oil Search in various locations around the planet in junior and executive exploration roles. He has specialised in the plate tectonic evolution, regional petroleum geology, play and prospect analysis and the hunt for new exploration opportunities in the Australasian region. He currently runs the industry training course on the Petroleum Geology of SE Asia (www.pgsea.com) and co-presents the Petroleum Geology of the North West Shelf course (www.pgnws.com). He has published extensively on the regional petroleum geology and, after deciding senior management is not for him, is currently enjoying working on his hobbies (now businesses) looking at real geology and not doing budgets, nor safety reviews, nor any management arse-covering pointless activities, nor attending endless meaningless meetings where time frequently stops. He is also joint developer and joint owner of the Player ArcGIS play analysis software (www.gis-pax.com) which is now used by 30+ international E&P exploration companies around the world. He lives in Perth, Australia where he has survived one shark attack and three forms of cancer and is now an increasingly average surfer who with increasing girth and added floatation is evolving into a slower ocean swimmer and hence now he is an even easier meal for the local sharks. His optimistic nature with regards to risk management strategies is thus self-evident in both his personal and professional activities where he believes that life is too short to take political correctness and established exploration paradigms too seriously and that everyone should enjoy a good laugh and a beer every now and then.