



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

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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 our 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!"

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- 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.