

PS Hydrocarbon Prospectivity of the Deep Water Phu Khanh Basin*

Tad Choi¹ and Jo McArdle¹

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¹Petroleum Geo-Services (PGS), Singapore (<mailto:tad.choi@pgs.com>)

Abstract

The Phu Khanh Basin, offshore Vietnam is a frontier basin covering an area of approximately 78,000 km². Exploration of the Phu Khanh Basin initiated in 1972 in the inboard shallow-water part of the basin. However, exploration in the deepwater area only began in 2008 when PGS acquired over 14,500 line km of long offset, partly GeoStreamer® multi-client 2D seismic, gravity and magnetic data. Several wells have been drilled post seismic acquisition and have proven the presence of a working petroleum system.

The Phu Khanh Basin lies on the central and southern Vietnamese continental margin, which marks the transition zone between the continental Indochina block and the South China Sea margin. The opening of the South China Sea during the Cenozoic has strongly influenced the development of the basin.

Interpretation of the seismic and gravity data supports the existence of two main depocentres filled with multiphase syn-rift Paleogene-Neogene sediments. The early syn-rift package is thought to host lacustrine-derived source rocks which are thought to be thermally mature, as evidenced by shows in the wells. Several inverted structures have formed due to the regional tectonics related to the opening of the South China Sea. The multiphase syn-rifting that occurred in the Phu Khanh Basin is also seen in the NW Palawan Basin (observations made on PGS's NW Palawan MC3D dataset), making these basins possible analogues to each other, with similar structures and play types.

Various play types have been identified in the Phu Khanh Basin, and they include: basement play, Miocene reefal build-ups on basement highs, Mio-Pliocene turbidite fans and Oligocene syn-rift clastics sealed under the regional Miocene unconformity. Various direct hydrocarbon indicators (DHI's) are observed in the seismic data at various stratigraphic levels. This, coupled with recent well results, gives further evidence for a working petroleum system in the Phu Khanh Basin. This study presents the prospectivity of the deep water Phu Khanh Basin.

Hydrocarbon Prospectivity of the deep-water Phu Khanh Basin, Vietnam

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Objective

To establish the basin stratigraphy, Petroleum Systems and identify the exploration Play Types of the Phu Khanh Basin, offshore Vietnam, based on interpretation of PGS's MC2D seismic data.

Introduction

The Phu Khanh Basin, offshore Vietnam is a frontier basin covering an area of approximately 78,000 km². The Phu Khanh basin lies on the central and southern Vietnamese continental margin, which marks the transition zone between the continental Indochina block and the South China Sea margin. The opening of the South China Sea during the Cenozoic has strongly influenced the development of the basin. Exploration of the Phu Khanh Basin initiated in 1972 in the inboard shallow-water part of the basin. However, exploration in the deep-water area only began in 2008 when PGS acquired over 14,500 line km of long offset, partly GeoStreamer® multi-client 2D seismic, gravity and magnetic data (Fig. 1).

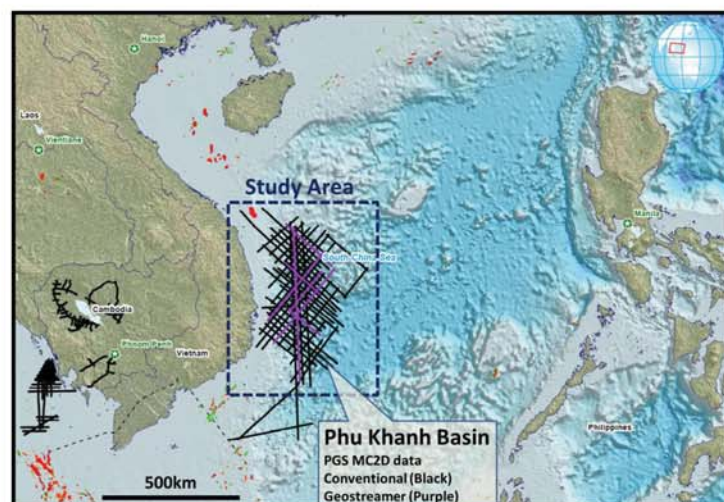


Figure 1: Location map of the study area and the PGS MC2D data.

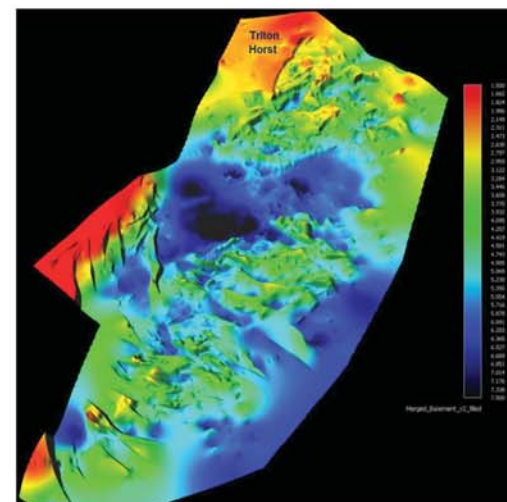


Figure 2: Basement TWT.

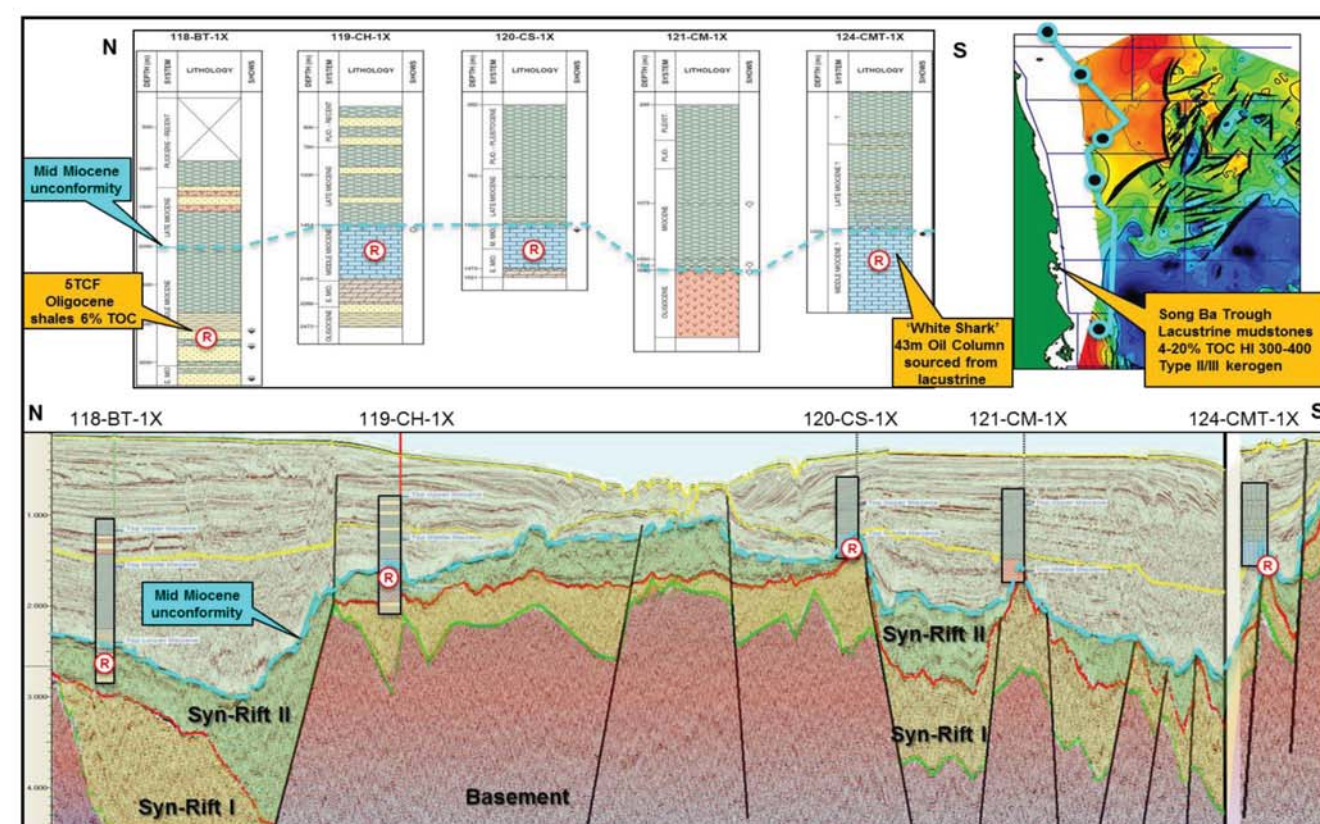


Figure 3: Geo-seismic section going through several wells and highlighting the major stratigraphic units.

Discussions

Wells were tied to seismic and detailed seismic interpretation was conducted with several regional key horizons picked including Basement (Fig. 2), Top Syn-Rift-I, Top Syn-Rift II and Mid-Miocene Unconformity. All these horizons mark significant regional tectonic events (Fig. 3).

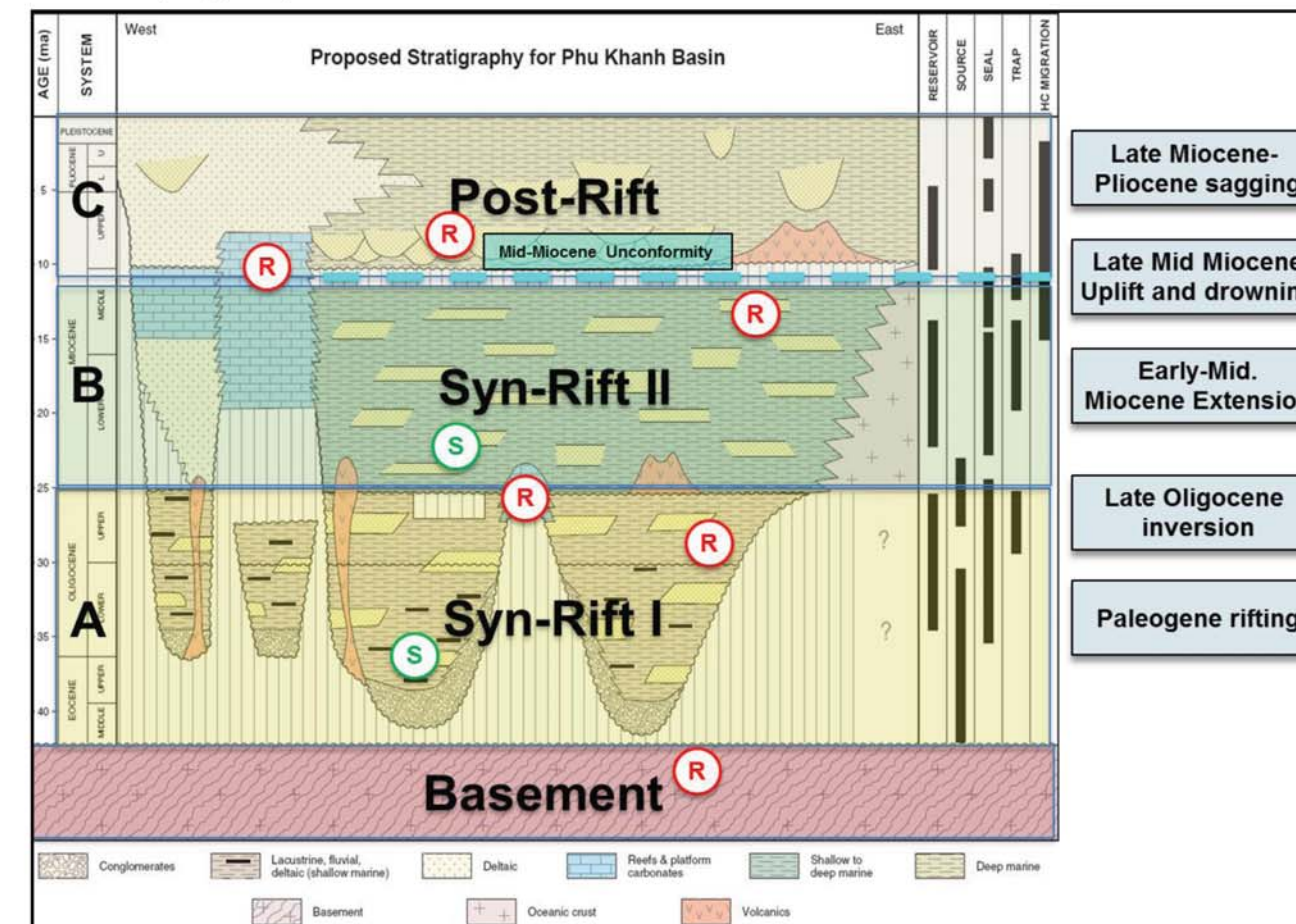


Figure 4: Key stratigraphic and major tectono units as well as the Petroleum systems of the Phu Khanh Basin.

The interpretation reveals that the Phu Khanh Basin consists of two major rifting events (Syn-Rift I in the Paleogene, thought to host clastics and lacustrine source rocks as seen in the Cuu Long Basin and Syn-Rift II, which may have a marine influence being associated with the opening of the South China Sea) (Fig. 4). A major mid-Miocene unconformity erodes the rift sequences with several carbonate reefs forming at this level, which has been the primary target for exploration for this basin. Overlying these are the post-rift (sag phase) sediments which include upper Miocene-Pliocene turbidite fans.

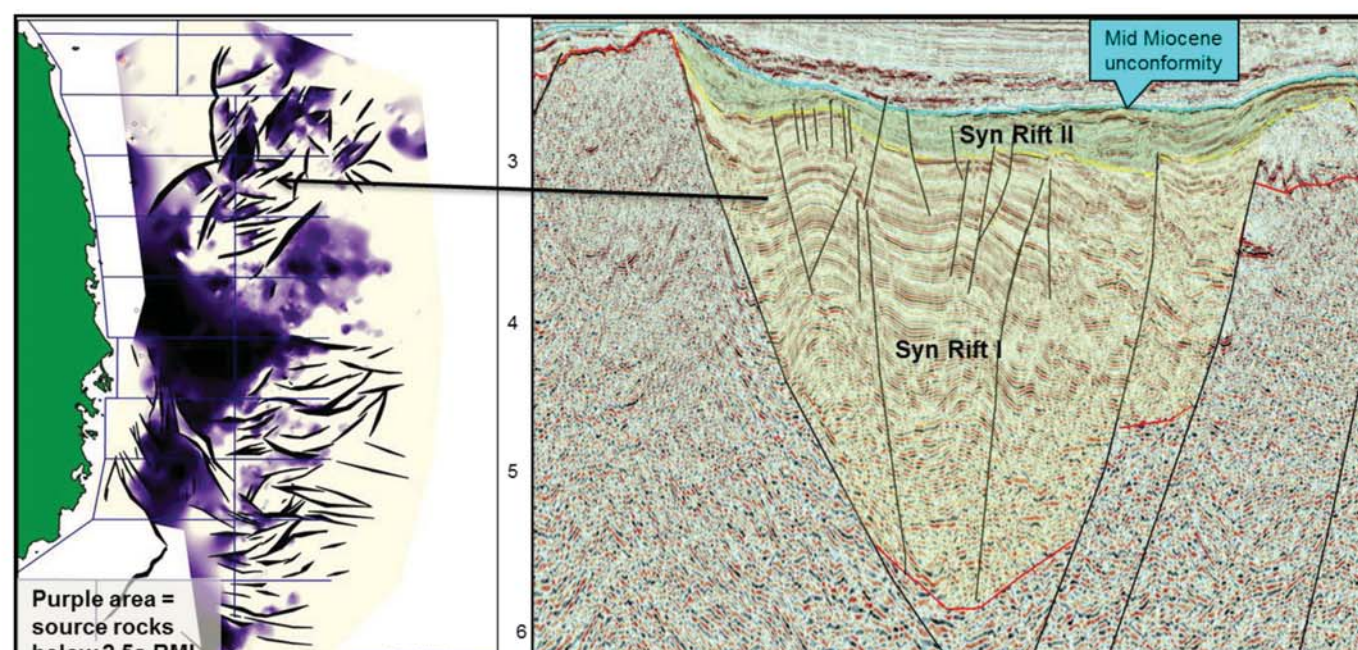


Figure 5: Example of thick Syn-Rift packages. Many of the Syn-Rifts contain possible source rocks that are deep enough to be thermally mature.

The Syn-Rift packages are found to be quite thick (+3secs) in some areas (Fig. 5). The inset map in Figure 5 shows that most of the Phu Khanh Basin's Syn-Rift I package (source rocks) sit below 2.5s below mudline (BML), and is thought to be present-day thermally mature, which is evidenced by several hydrocarbon shows and discovery wells in this basin, as shown in Figure 3.

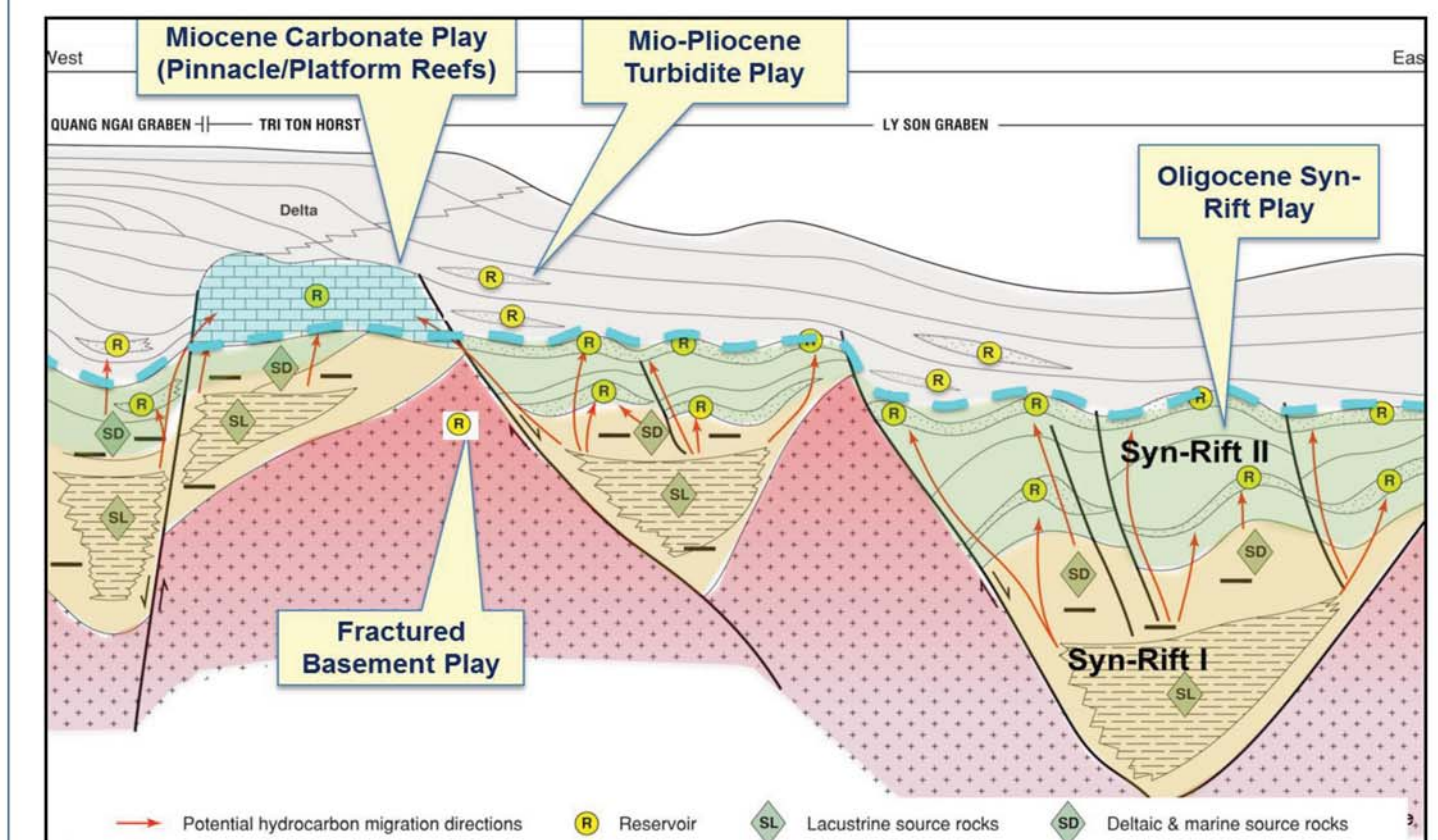


Figure 6: Schematic summary of the Play Types of the Phu Khanh Basin.

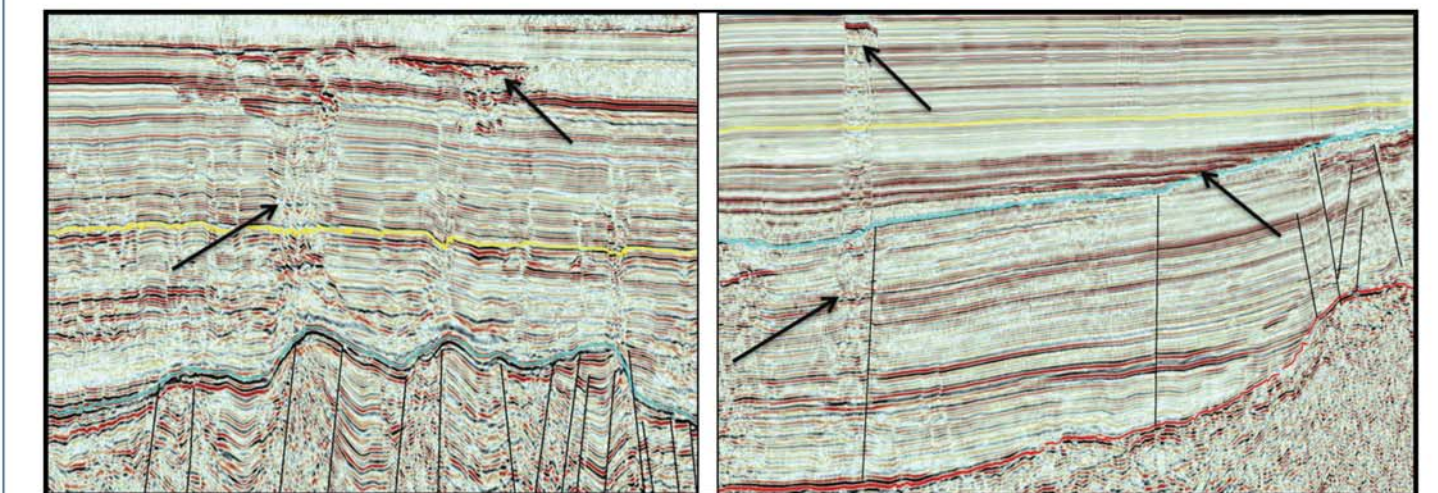


Figure 7: Several DHI's seen throughout the dataset.

Conclusions

- 2 Rift phases:
 - Syn-Rift I Late Eocene/Oligocene age.
 - Syn-Rift II Early/Mid Miocene rift.
- Oil shows/discoveries have been made (ie. White Shark) in Miocene Carbonates.
 - HC modeling as well as gas chimneys and DHI's (Fig. 7) indicate the presence of a working petroleum system in the Phu Khanh Basin.
- Various Play Types (Fig. 6)
 - Miocene carbonates
 - Oligocene-Early/Mid Miocene Syn-Rift clastics (ie Yacheng Field)
 - Upper Miocene-Pliocene basin floor fans
 - Fractured basement (similar to Cuu Long)