

## **New Horizons: Oil and Gas Potential from the Cretaceous to Permo-Carboniferous, South Central Laos**

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### **Summary**

This talk presents a geotechnical evaluation of exploration prospectivity in a south central basin in Laos. The relevant geology, stratigraphy and structural regimes are presented as a backdrop to the geophysical mapping and analysis of potential prospects in the area. Forward exploration plans are presented and discussed with an emphasis on advanced geotechnical techniques and their application in this basin. This talk demonstrates the challenge of defining exploration prospects using multiple techniques in a high potential / high reward environment.

### **Introduction**

This Laos onshore exploratory basin lies east of Thailand and west of Vietnam, in the south central part of the country. The closest production is from the Hess operated SinPhaHorn gas field, 200 km to the west in the Khorat basin of Thailand. The field was discovered in 1983 and currently produces 90 Mmcf/day. A total of 2600 km of 2D legacy seismic lines have been acquired over the prospect area covering 2.9 million acres and have been integrated into the seismic interpretation and mapping.

Three wells have been drilled in the country to date, one most recently in the subject basin. The exploration in the area started in 1990 and has seen three exploration companies commit to geological field work, geophysical acquisition and minimal well commitments. The most recent well, drilled in 2010 by Salamander Energy, has been declared a gas discovery well. The well encountered C1-C3 gas shows on the mud log in the upper Cretaceous and a wet porous carbonate reservoir in the lower Permo-Carboniferous. Oil seeps and bitumen staining have been noted to the east and north of this well. It is this well, the geological surface mapping and geophysical databases that are key to defining the prospects in the area.

### **Method**

Petrophysical analysis combined with outcrop data is used to define the reservoir parameters of the prospective formations in the basin. A key 2D seismic line is tied to the recent gas well discovery by Salamander Energy. This well tie and corresponding synthetic is used to identify the prospective formations for the purposes of seismic mapping. This correlation is also used for phase and bulk shift corrections where necessary for the remainder of the seismic lines in the database. The data is fair to good quality and portions of the data have been reprocessed as late as 2010.

The seismic interpretation is compared with corresponding geological field mapping and other geophysical techniques used in the past, such as potential field data, and this information is integrated into the new interpretation where possible. The structural styles, stratigraphy and producing information from adjacent producing fields are discussed and compared to the prospects in this relatively unexplored basin.

Maps are generated that outline the prospects within the basin. The inherent risks with the prospects are analyzed with the focus on further work to reduce risk before drilling. The further work will emphasize geotechnical technology that hasn't yet been applied to the dataset but has the potential to improve the exploration results.

## Examples

Some of the examples shown are the discovery well on seismic, the mapping of key formations and analogous producing pools in Thailand. This example shows the challenge of imaging the prospects in the basin and also defining effective trapping configurations with 2D seismic. Although a four way closure was interpreted and mapped in the shallower Cretaceous, the deeper Permo-Carboniferous target was porous and wet.

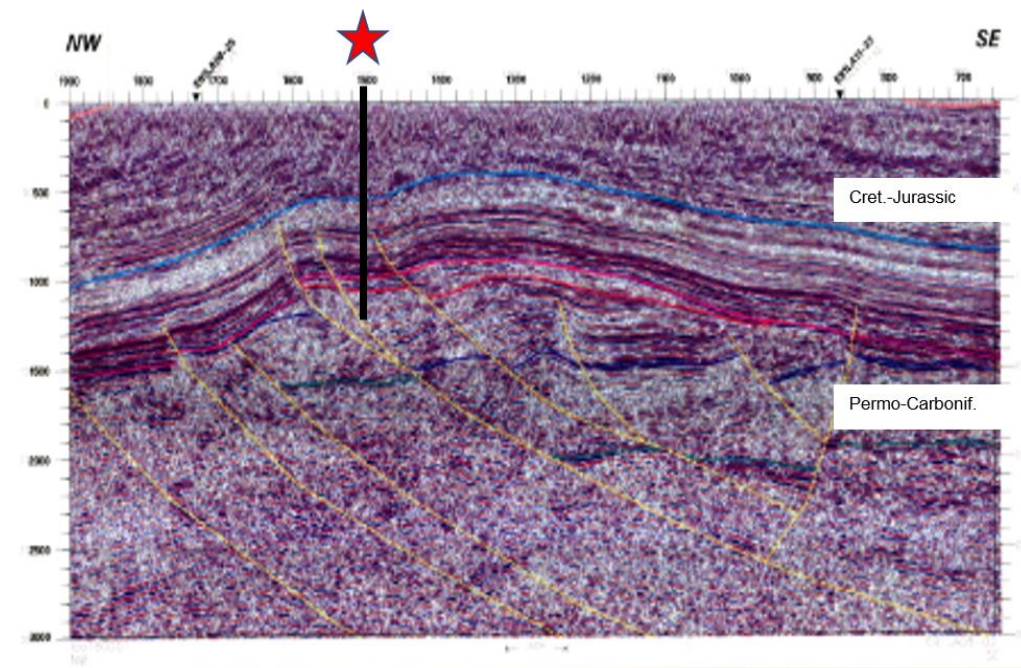


Figure 1: Key NW-SE 2D seismic line through Salamander Energy discovery well

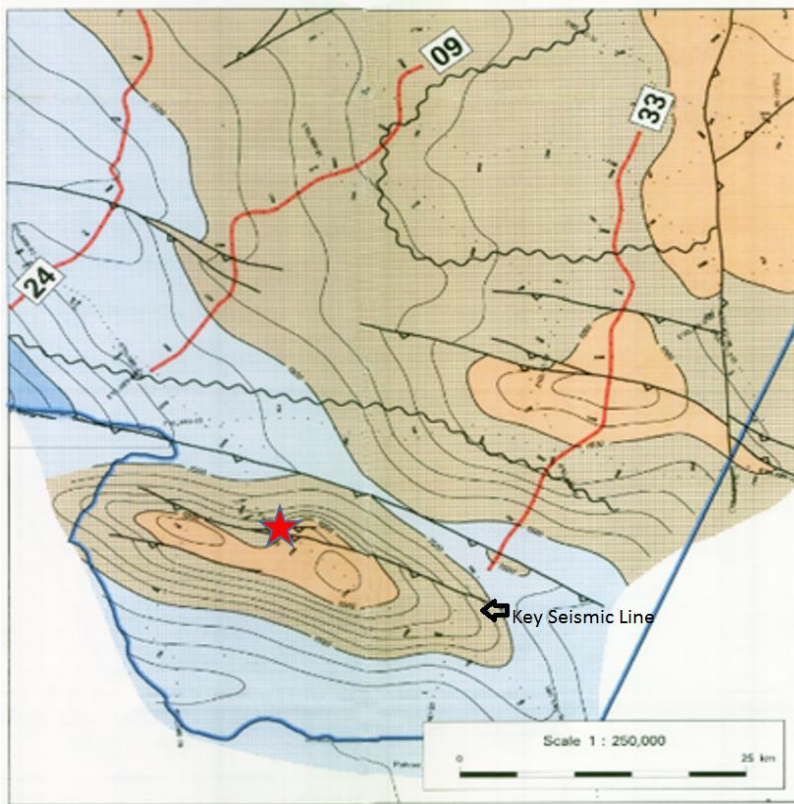


Figure 2: Base of Jurassic Time Structure Map with discovery well highlighted

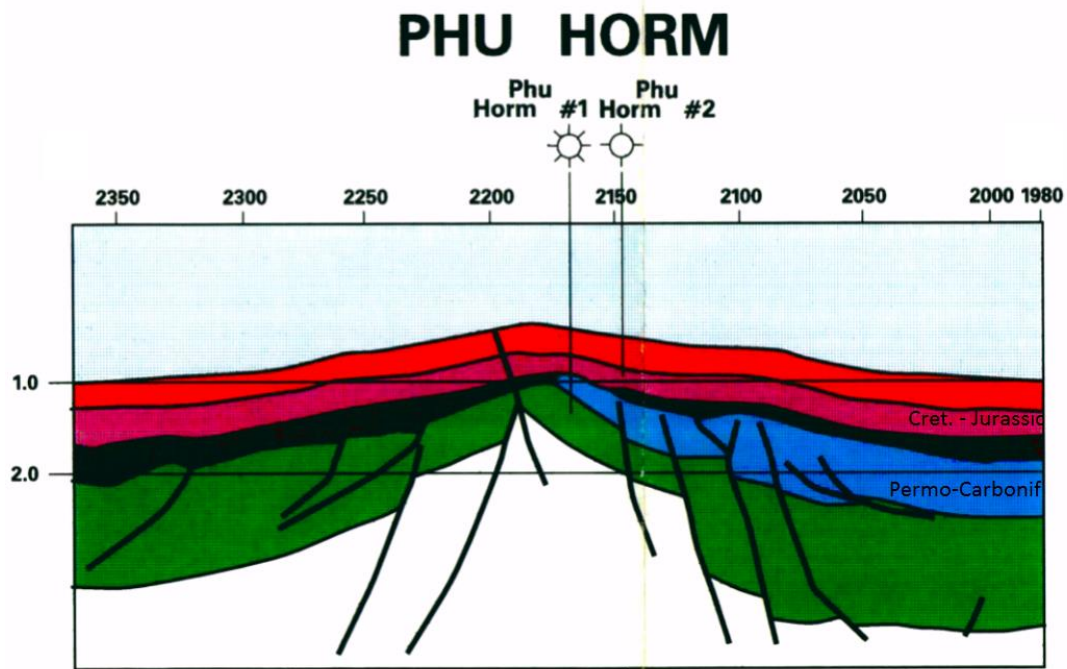


Figure 3: Schematic of production analogue from SinPhaHorn gas field, Thailand

## **Conclusions**

The geology and stratigraphy have been shown to support multiple prospective hydrocarbon bearing formations in this south central basin of Laos. These are the shallower Cretaceous group of formations as well as the deeper Triassic to Permo-Carboniferous. Petrophysical analysis and outcrop data support an oil and gas charged basin.

The structural regime is complex and reflects multiple episodes of compression, uplift and corresponding erosion. It is this complex structural history combined with stratigraphy that leads to multiple opportunities for the identified prospects.

Using 2D seismic to map the structures and required closures is more challenging for the deeper carbonate targets than for the shallower prospective horizons as a result of the complex structure below the overlying Cretaceous sediments.

Improved seismic processing techniques, denser seismic control combined with additional advanced geotechnical methods are recommended to better define the prospects within the basin prior to drilling.

## **Acknowledgements**

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## **References**

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