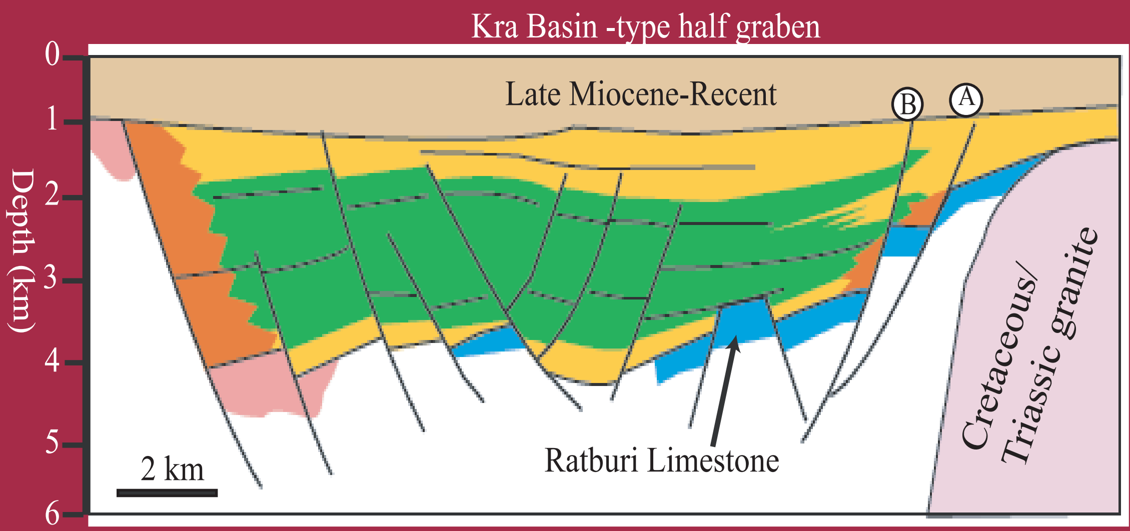
Bulletin of Earth Sciences of Thailand (BEST)

Volume 3 Number 2 October 2010

BEST

International Journal



Petroleum Geoscience

ISSN 1906-280X

Bulletin of Earth Sciences of Thailand (BEST)
International Journal of Earth Sciences

Bulletin of Earth Sciences of Thailand (BEST) is an international journal and publishes peer-reviewed works across the geosciences and earth sciences disciplines from fundamental theory and sciences to applied research of relevance to sustainable management of the environment.

ISSN: 1906-280X

Cover: A schematic model of the Kra Basin (page 3)

Editorial office:
Department of Geology, Faculty of Science, Chulalongkorn University, Phrayathai Road., Bangkok 10330, THAILAND.
Telephone: 66-2-218-5445, 218-5442-3 Fax: 66-2-218-5464
Website: http://www.geo.sc.chula.ac.th/geonew/Page/BESTjournal.php Editor Email: monkeng@hotmail.com

Preface

The Bulletin of Earth Sciences of Thailand (BEST) has established itself as an international academic journal of the Geology Department, Chulalongkorn University (CU) since the year 2008. This Number 2 issue of Volume 3 is devoted specifically to the publications contributed by the International Petroleum Geoscience M.Sc. Program of the Geology Department, Faculty of Science, CU for the academic year 2009/2010. Certainly this Bulletin has attained more and more international recognition, not to mention the citation of publications in previous volumes, as can be seen from the contributions of 17 research papers by international students of the M.Sc. program. This program is an intensive one year curriculum that has been taught in the Geology Department of CU in the academic year 2009/2010 for the first year. These scientific papers were extracted from the students' independent studies which are compulsory for each individual student in the program. Because of the confidentiality reason of a number of contributions, the requirement of the Chulalongkorn Graduate School as well as time constraints of the program, only short scientific articles were able to release publicly and publish in this Bulletin.

Lastly, on behalf of the Department of Geology, CU, I would like to acknowledge the Department of Mineral Fuels, Ministry of Energy, Chevron Thailand Exploration and Production, Ltd, and the PTT Exploration and Production Public Co., Ltd., for providing full support for the Petroleum Geoscience Program and the publication cost of this issue. Sincere appreciation also goes to guest editors; Professors Joseph J. Lambiase, Ph.D., John K. Warren, Ph.D., and Philip Rowell, Ph.D., the full-time expat staff, for their contributions in editing all those papers. Deeply thanks also go to Associate Professor Montri Choowong, Ph.D., the current editor-in-chief, and the editorial board members of the BEST who complete this issue in a very short time. The administrative works contributed by Ms. Suphannee Vachirathienchai, Ms. Anamika Junsom and Mr. Thossaphol Ditsomboon are also acknowledged.

Associate Professor Visut Pisutha-Arnond, Ph.D.
Head of the Geology Department
August 2010

Bulletin of Earth Sciences of Thailand

Identification of Shallow Pay Zones in the Tantawan area, Gulf of Thailand

Rampueng Kawphoy*

Petroleum Geoscience Program, Department of Geology, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand

*Author email: rkhc@chevron.com

Abstract

The objective of this study was to evaluate the potential shallow pays in the Tantawan area and recommend an evaluation program based on seismic amplitude distributions and risk identification. Known shallow pays were characterised in order to find potential new pays located above the Middle Miocene Unconformity (MMU). Well log analysis, mud log interpretation and seismic amplitude studies were used to evaluate these pays. Seismic time slices were studied to identify the distribution of seismic amplitudes and depositional environments together with amplitude attribute studies. Based on these observations assumptions of potential new pays were created based on: 1) reservoirs are fluvial sands, 2) normal faults are main traps and migration pathways, and 3) a model pay sand is a gas sand with a high amplitude response. According to these three assumptions the possibility of potential new pays can be divided from low to high confidence, which is POSSIBLE NEW PAY, MOST LIKELY NEW PAY and PROBABLE NEW PAY. The best four locations were recommended for further evaluation based on possibility and size of amplitude anomalies.

Keywords: Shallow Pay Zones, Tantawan area, Seismic Amplitude Study

1. Introduction

The Tantawan area is located in Block B8/32 and Block 9A, Pattani basin, Gulf of Thailand. The productive interval is mainly from fluvial sands of Middle Miocene age (Chevron, 2003). Most production wells focused on the pay windows below the Middle Miocene Unconformity (MMU) and about 200 ft above the MMU. This study is focused on the evaluation of potential shallow pays above the MMU (Figure 1). The objective of the study was to evaluate the potential shallow pays using mud logs, wireline logs and seismic data. Based on the seismic amplitude distributions identified and the risks associated with them, an evaluation program is recommended.

2. Methodology

The first step was to scan the dataset for amplitude anomalies using time slices every 20 ms and 4 ms TWT. The wireline logs and mud logs were used to identify pay and confirm the lithology. Interesting sands and coal markers were correlated for mapping. Two synthetic seismograms were generated to identify seismic polarity and impedance of rocks. Tuning thickness was calculated for various depth intervals. A selected amplitude range was determined as a reference point which probably represented pay sand. The pay sand model needed to be low impedance with a high amplitude response. The MMU, Coal 1 and Coal 2 were mapped to identify structure and to represent important events (Figure 1). Sand maps and RMS amplitude maps were mapped to identify sand geometry, depositional environments and amplitude response.

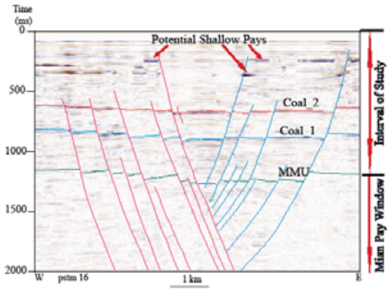


Figure 1. The main pay window and interval of study.

3. Results

3.1 Amplitude response of known pays

Based on the seismic time slice study the seismic amplitude response is higher towards the surface. Fluvial sand deposits are the main reservoirs and the character of these channels are shown very clearly in between the surface and 300 msec. But not all high amplitudes represent pay sands. Sands and coals have relative low impedance and shales have high impedance. The top of sands and coals are represented by troughs. Gas sands, oil sands and wet sands are not significantly different in amplitude response. In some cases a high amplitude indicates thick clean sands. The tuning thickness study shows that most of the pay sands thicknesses are thinner than tuning thickness. Moreover, the amount of hydrocarbon fill in reservoirs, and the depth of burial are all affecting the amplitude responses of the pay sands. However, one gas sand from the TAWK-08 well (Figure 2) shows a significant amplitude anomaly from background, and can be used as a model and applied to evaluate potential new pays in others zones.

3.2 Potential Hydrocarbon Pays

Most known shallow pays are located behind faults and this suggests that faults are the main trap and migration path in this area. Structures are a significant factor in hydrocarbon accumulation. Based on the characteristics of known pays the assumptions of potential new pays are: 1) reservoirs are fluvial sands, 2) normal faults are main trapping mechanism and migration pathways, and 3) a model pay sand is gas sand with a high amplitude response which is used as an amplitude cut-off. The decision tree of classification of potential new pays based on risk identification is shown in Figure 3. The application of using a model pay sand resulted mainly in the identification of potential pays located behind big faults and in the graben center. According to amplitude distribution, four potential new prospects were identified to be the best recommended areas for further evaluation (Figure 4).

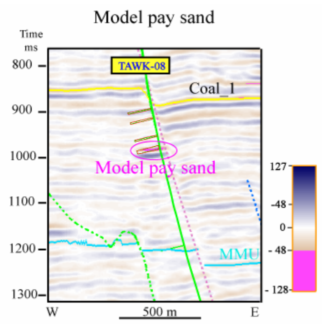
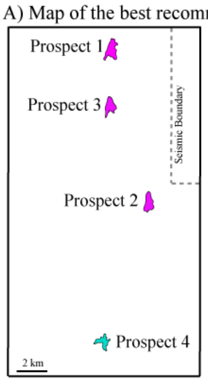


Figure 2. A reference amplitude which represents pay sand in the TAWK-08 well.

Figure 3. The decision tree of potential new pay classifications.

A) Map of the best recommended prospects



Prospects	Risk	Area (Km2)	Time Interval	Remarks
1	PROBABLE CASE	0.60	400-600 msec	Big area, Located behind fault and isolated anomaly
2	PROBABLE CASE	0.44	400-600 msec	Big area, Located behind fault with stacked anomalies
3	PROBABLE CASE	0.41	400-600 msec	Big area, Located behind fault, and isolated anomaly
4	MOST LIKELY CASE	0.38	800-1000 msec	Big area, Located in the graben center (anticline form) and isolated sand

B) The best recommended prospects information

Figure 4. The best recommended prospects.

4. Discussion

It is clear that amplitude anomalies alone cannot confirm a hydrocarbon accumulation in Tantawan area. The best probability to find shallow pays relies on three tests; 1) it passes the amplitude cut-off criteria, 2) it has structural controls and is located in a relative high area, and 3) it shows fluvial sand depositional characteristics. However, the limitations of the seismic data have to be considered. For example, the choice of scaling of maximum unclipped amplitude parameter is important as the true amplitude of seismic reflectors varies with depth. Also, understanding the tuning thickness of the potential pays is important. Moreover, the percentage of shale in the sands can influence the amplitude response. Lastly, the amplitude response of low impedance sands and coals are very difficult to distinguish by identified amplitude values alone.

5. Conclusions and recommendations

Most of the potential shallow pays are located behind big faults and in the graben center associated with structural control. The potential new pays are divided into three probabilities based on the criteria shown in Figure 3. These are POSSIBLE NEW PAY, MOST LIKELY NEW PAY and PROBABLE NEW PAY. Limitations, such as scaling, true amplitude, tuning thickness, rock quality and their impedance, have been considered to reduce the mistakes of applying the risking criteria.. Processing tools to filter amplitude ranges of sand and coal, and the use of 4D seismic data to check the possible migration of hydrocarbons are recommended to define potential shallow pays more accurately. The section between 400 to 1000 msec was found to be the interval which contains the best four prospects. These are recommended for further evaluation.

6. Acknowledgements

I would like to express my sincere gratitude to Chevron Thailand Exploration and Production Ltd. (CTEP), the CTEP staff, Dr. Philip Rowell, my university supervisor, Dr. Joseph J. Lambiase, Dr. John K. Warren and all internal and external lecturers. Many thank to Halliburton company for providing the software to use in this study.

7. Reference

Chevron offshore Thailand, Ltd., 2003. Block B8/32, Gulf of Thailand, Petroleum System and Implementation of Technology in Field Development. *Internal report* : 21 p.