

World Developments in 2006

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*Adapted from article entitled “’06 Charts Some Remarkable Finds” published in AAPG Explorer, January, 2007. The list of major discoveries, together with the tables, was provided by IHS (formerly IHS Energy), with IHS comments.

Introduction

In a year of nationalizations (e.g., Venezuela and Bolivia) and severe contract and political challenges (Russia and just about everywhere else), 2006 was a year with few jaw-dropping discoveries being reported. However, there were some important finds that opened up some new areas, bolstered nearby producing areas and provided more building blocks for the future.

The following are major discoveries, provided by IHS (formerly IHS Energy) over the past year, with IHS commentary on the impact of the finds and some scouting reports on the wells. They are shown on a relief map (Figure 1) and on Sedimentary Provinces map of St. John et al. (1984) (Figure 2). Each region is accompanied by a list of discoveries, also provided by HIS (Tables 1-9).

Australasia

(Maps [Figures 1, 2] Discovery List—Table 1)

Australia

Drilled by Chevron, **Clio 1 (square)**, is located to the west of Gorgon Field. Although no official reserves estimate has been released, it is understood to be “significant” and to have encountered a 190-meter gas column in the Mungaroo Sands, the biggest to date in Australia. It also is rumored to be lower in CO₂ than the nearby Gorgon Field, which could mean that the Gorgon gas project could be developed without initially requiring so much CO₂ re-injection and so lowering the upfront development costs.

Xena 1ST1 (diamond), drilled by Woodside, is not a large discovery (reserves estimated at less than 0.5 Tcf), but it is located in the same block as the 2005 Pluto discovery, which is undergoing a fast track LNG development. On its own, Pluto is considered just about large enough to support such a project. However, various developmental problems, such as, much of the Burrup Peninsula becoming protected due to Aboriginal rock art and the possibility of domestic gas reservations, mean that additional gas, again discovered on a 100% Woodside-owned basis, can only help this project fly.

The year 2006 saw very few significant oil discoveries, with the biggest commercial success being Tap’s Amulet discovery on the North West Shelf. This has reserves of 10-15MMbo.

Other significant discoveries, for commercial rather than size reasons, were Coogee’s Swift North and Swallow wells. Together with Montara, these discoveries have reserves in the region of 30 MMbo (24 MMbo from Montara) and will now make a joint development conceivable. This could help open up the Ashmore and Cartier region to future exploration and development activities.

Papua New Guinea

SPI's **Elk 1** wildcat in Papuan Foldbelt license PPL 238 is potentially a significant find that has tested up to 50 MMcfg/d, while a second DST over the interval 1,640-1,856m flowed 21.7 MMcf/d through a 60/64-inch choke. High quality condensate with an API between 46-49° also flowed. Analysis suggests the existence of a possible oil leg at Elk and a theoretical gas column in excess of 1,000 meters.

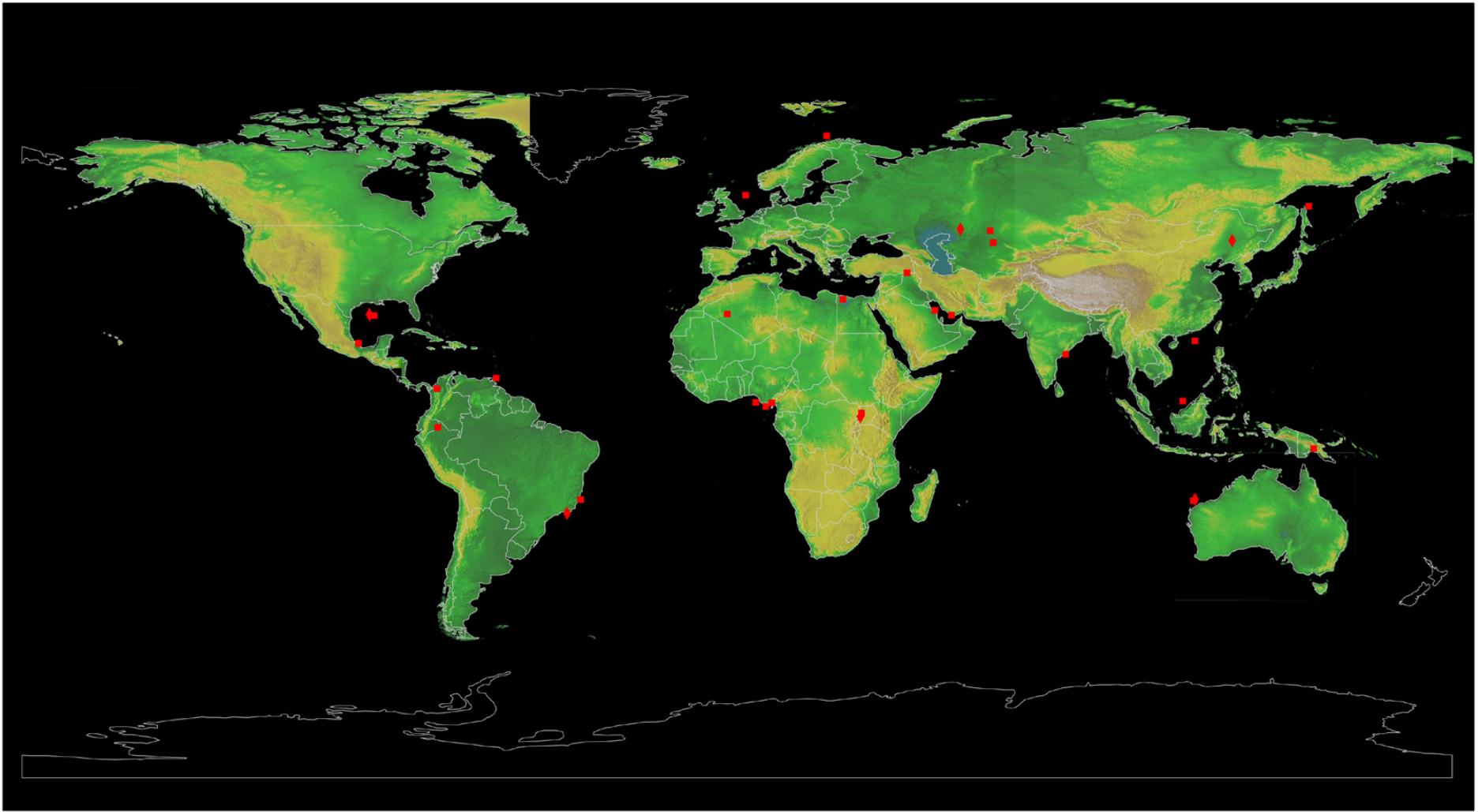


Figure 1. Major discoveries, 2006.

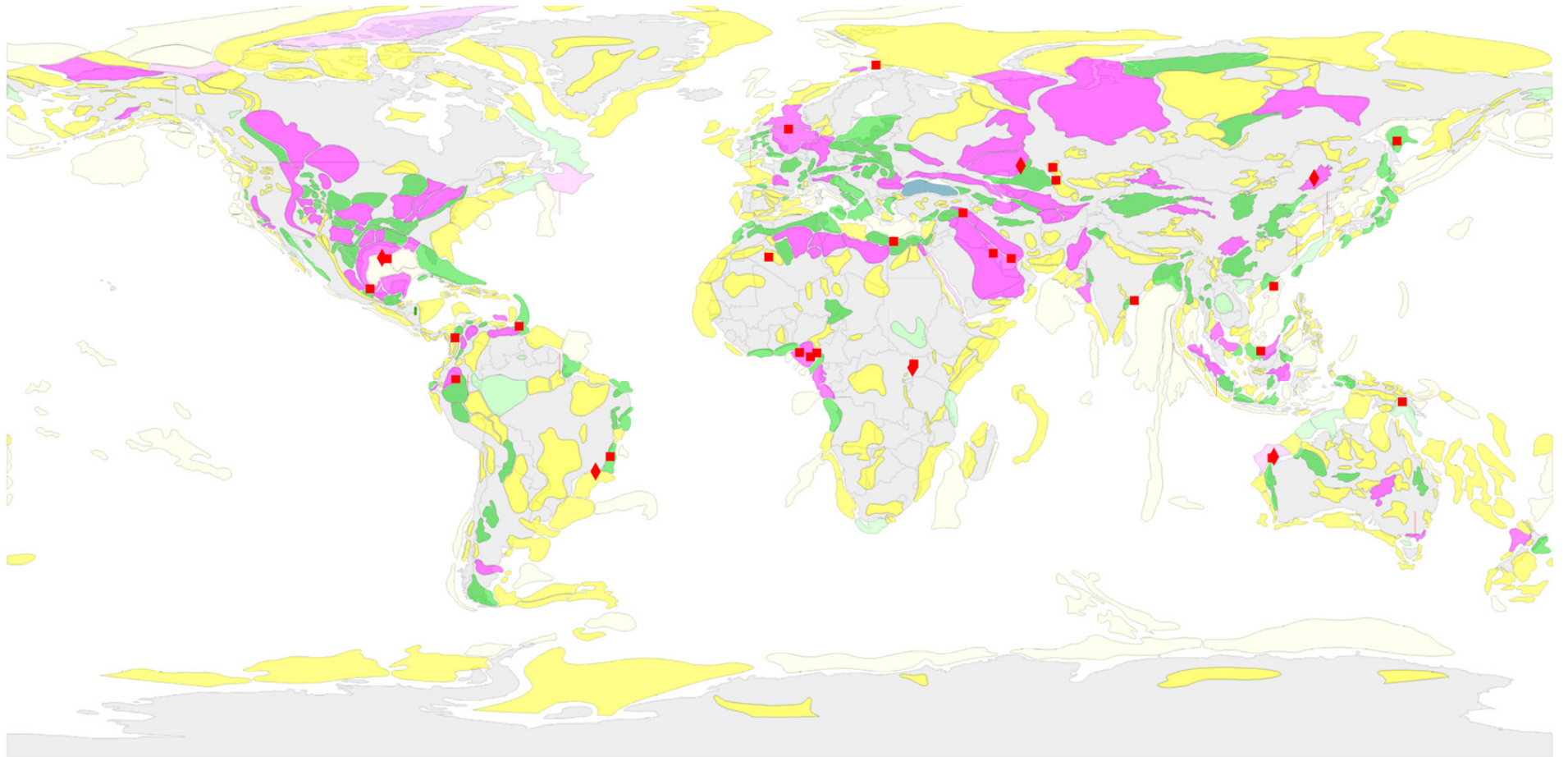


Figure 2. Major discoveries, 2006, on Sedimentary Provinces map by St. John et al. (1984).

Far East

(Maps [Figures 1, 2] Discovery List—Table 2)

China

Located in 1480 meters of water in the South China Sea, Husky's **Liwan 3-1 1 (square)** in the PSCA 29/26 license is a significant gas discovery, as it is the first true deepwater discovery, and it has possibly identified a structure with potential reserves of 6 Tcf. The well is located on the eastern end of the Zhu II Depression, seeking objectives in the Upper Oligocene Zhuhai Formation and Lower Miocene Zhujiang Formation. The well logged 56 meters of net gas pay in two zones, and extends the natural gas trend first revealed by Panyu 30-1 1 and Panyu 34-1 1 wells.

Sinopec Star's **Yaoshen 1 (diamond)** wildcat is a good gas discovery well, a single drillstem test flowing 7.2 MMcfg/d from a deep volcanics reservoir between 3540-3750 meters in the Lower Cretaceous Yingcheng Formation. The discovery is estimated to hold roughly 1.1 Tcf of 2P gas in-place.

India

Drilled by Reliance, the **D6-MA-1 (Dhirubhai 26)** exploration well on the KG-DWN-98/3 (D6) (Krishna-Godavari Offshore) is located in 1800 meters of water and is the first Cretaceous discovery to be made on the acreage. It is understood to have penetrated 26 meters of net oil pay and 72 meters of net gas pay; the oil horizon tested at an equipment-restricted flow rate of over 6700 bo/d and 10.96 MMcf/d through a 64/64-inch choke, while the upper gas horizon flowed over 32 MMcf/d and 3370 bc/d through a 80/64-inch choke. The well is believed to have opened a significant new play and could have a material impact on the future exploration potential of the block.

Malaysia

In the **PC4 1** well, located in the north of the open SK-310A permit, Petronas encountered a 630-meter gas column, a record for Sarawak.

Commonwealth of Independent States (CIS)

(Maps [Figures 1, 2] Discovery List—Table 3)

Kazakhstan

Petrom claims its **Rovnaya South 1 (square)** wildcat in the Turgay Basin is a significant discovery, with the well flowing 6.9 MMcfg/d and 440 bc/d, from what is thought to be the Middle Jurassic Doshchan Play.

TengizChevroil wildcat **Ansagan 1X (diamond)**, some 18 kilometers west of the Tengiz Field, establishes a 135-meter oil column in a low permeability reservoir in what is believed to be a pre-salt Carboniferous limestone unit. The result high-grades a number of pre-salt structures in the area.

Russia

The **Vasyukanskaya Yuzhnaya 1** wildcat makes it three out of three for BP/Rosneft on its offshore Kaygan-Vasyukanskiy block (Sakhalin-5 project), an area that was opened by the Pela Lache find in 2004. Rosneft estimates reserves for the structure at 110 MMb.

Uzbekistan

The **Yumay 1** wildcat drilled by Uzbekneftegas proved to be a modest oil discovery in the gas-prone basin Amu-Darya Basin. The well flowed 264 bo/d through a 3.5mm choke from the Callovian-Oxfordian carbonates.

Middle East

(Maps [Figures 1, 2] Discovery List—Table 4)

Iran

NIOC's **Kish 2** gas discovery is ranked a supergiant find with reserves of 36 Tcf and one of the most important gas discoveries in the world in recent years. The Triassic Kangan Formation tested 31 MMcfg/d; the underlying Permian Upper Dalan tested at 30 MMcfg/d; with the Nar Member flowing at 14 MMcfg/d, all using the same 5/8-inch choke.

Iraq

DNO's **Tawke 1** in the Kurdistan region was suspended after the well yielded a maximum flow of 5000 bo/d from one shallow reservoir estimated to be up to 800 meters thick, at a depth of 350 meters. DNO had estimated oil reserves in the Tawke structure at 330 MMb in place with 100 MMb recoverable, figures that may increase given the successful appraisal. The well is regarded as the country's first significant oil find since 1993.

Saudi Arabia

Saudi Aramco's **Karan 6** deeper pool wildcat tested gas at a rate of 40 MMcf/d, and is claimed as the Kingdom's largest gas discovery with reserves of 10 Tcf. The well was the first in an 11-well deep gas exploration program, and through 2006 it was followed by gas finds at Nujayman, Kassab and Zamlah.

Europe

(Maps [Figures 1, 2] Discovery List—Table 5)

Norway

Statoil encountered gas in several Late Triassic Sandstones in its **7122/6-2 (Tornerose)** well. Although not tested, the discovery is to be evaluated as part of the resource base for a potential expansion of the LNG plant at Melkøya. Further development of the LNG plant, however, would require more gas than Tornerose could potentially supply. This result is seen as giving a boost for Barents Sea exploration plans.

United Kingdom

ConocoPhillips well **30/6-6 (and 6z)** on the Shoei prospect confirmed the presence of a substantial commercial hydrocarbon accumulation. Partner BG Group reported that the estimated recoverable reserves are between 100 and 275 MMboe, making this one of the largest North Sea finds in recent years. It is on first round acreage that has been held under license for over 40 years.

Saharan Africa

(Maps [Figures 1, 2] Discovery List—Table 6)

Algeria

Repsol's **Kahlouche 2 (KL-2)** wildcat in Blocks 351c/352c, Reggane Nord permit, Timimoun Basin, is a significant discovery because it opens up a new trend by testing gas in the Carboniferous section for the first time in this basin. The well flowed an aggregate of 44.0 MMcf/d from two intervals. DST 1 tested 26.95 MMcf/d through a 32/64-inch choke in a Siegenian section below 3983 meters. DST 2 tested 17.06 MMcf/d, through a 32/64-inch choke in the Tournaisian below 2360 meters.

Egypt

Apache successfully tested a new Jurassic play with its **Kahraman B-22** well in the Khalda Concession. The well appraised the westward extent of the shallow Kahraman "B" Bahariya oil field and investigated deeper traps in the Alam el Bueib and Jurassic Safa formations. It logged a total of 25.6 meters of net pay in Jurassic sands between 3773 and 3916 meters. The Lower Safa tested at an average rate of 16 MMcf/d and 486 bc/d on a two-inch choke.

New wells are planned in the Shushan "C" concession to investigate the possible extension of this Jurassic play, as Apache believes both sand quality and pay may improve to the north.

Sub-Saharan Africa

(Maps [Figures 1, 2] Discovery List—Table 7)

Cameroon

Total's **Dissoni Marine 2** appraisal well in its Dissoni Block, Rio del Rey Basin, shallow offshore, encountered around 50 meters of oil pay in a massive oil-bearing sandstone in the Alternances Formation. This successful appraisal of a 2000 discovery may signal the start of a new offshore development, the first in a number of years.

Nigeria

Shell's Bonga **North 2X** dual leg appraisal to the Bonga North 1X discovery in OPL 212 penetrated 90 meters of hydrocarbon-bearing sands in several intervals. It is believed Shell is trying to prove up-enough reserves (500 MMb+) that could lead to Bonga North being developed separately from Bonga.

Nigeria - Sao Tome & Principe JDZ

The first deepwater well in the JDA, Chevron's **Obo 1**, encountered a cumulative 45 meters of net hydrocarbon pay in multiple reservoirs. Reserves are rumored to be not as large as expected, leading to speculation that the well was not spotted at the most prospective location but rather on the edges of a major structure to check its extent.

Uganda

The year 2006 hosted a run of discoveries that proved a significant step forward not only for Uganda but for East Africa in general.

Hardman's **Mputa 1 (square)** wildcat was hailed as the country's first oil discovery; **Waraga 1 (square)** (also Hardman) achieved an aggregated test rate of over 12,000 bo/d -- an important incentive for future exploration of the Albertine Graben and other rift basin areas.

The **Kingfisher 1 (diamond)** discovery drilled by Heritage confirms the trend.

Latin America

(Maps [Figures 1, 2] Discovery List—Table 8)

Brazil

Petrobras suspended **4-ESS-164A** (4-BRSA-406A-ESS) (**square**), a well that may be regarded as its best discovery in 2006. The company reports it had discovered 280 MMboe of 38° API oil. It lies in 871 meters of water and was targeting Cretaceous turbidites.

The Petrobras **1-RJS-628A** (1-BRSA-369A-RJS) (**diamond**), as an oil and gas discovery, tested 4900 bo/d 30° API and 5.3 MMcfg/d through a 40/64-inch choke. This well potentially could have discovered a field greater than 1 Bboe, and if proved, it would represent a supergiant field in a totally new geological province in Brazil. It would certainly represent the most important discovery in Brazil since Roncador in 1996.

Colombia

Canadian explorer Pacific Stratus Ventures plans early production of its **La Creciente 1 (LC-1)** as a gas discovery on the La Creciente Block in the Lower Magdalena Basin. In the Cienaga de Oro Formation, the primary objective, the company flowed 29.1 MMcfg/d through a 32/64-inch choke, saying the well has the potential to yield up to 71.8 MMcfg/d.

Mexico

The **Noxal 1** wildcat, drilled by Pemex in the Catemaco Fold Belt offshore, is claimed as Mexico's first gas discovery in its deep waters of the Gulf of Mexico. A test in the interval 2137 to 2147 meters in the highly porous Lower Pliocene flowed 9.5 MMcf/d of gas. Reserve estimates are placed at 245 Bcf in this previously considered oil-prone sector of the Gulf of Mexico. This likely new producing region, to be known as Coatzacoalcos Profundo (Deepwater Coatzacoalcos), might hold as much as 10 billion BOE.

Peru

Repsol-YPF's **Raya 1-X** oil discovery on Block 39 in the Marañon Basin only flowed around 2000 bo/d from two intervals, but it may tip the balance in favor of developing a series of discoveries in a heavy oil trend.

Trinidad & Tobago

BHP-Billiton's **Kingbird 1 (square)** apparently penetrated a number of thrust faults resulting in repeats of the Lower Miocene and Oligocene section without reaching the top of Cretaceous. The well encountered hydrocarbon-bearing Oligocene Angostura sands and approximately 24 meters of gross hydrocarbon pay.

The subsequent **Ruby 1 (square)** well was even more significant, establishing 366 meters of gross hydrocarbon-bearing sands, including more than 244m of net pay. The well tested at a rate of approximately 5000 bo/d on a 7/8-inch choke.

Frontier U.S.A. and Canada

(Maps [Figures 1, 2] Discovery List—Table 9)

Gulf of Mexico

The deepwater **Jack (square)** discovery drilled by Chevron in 2005 was tested in 2006, and this provided confirmation with regard to the commerciality of the emerging Lower Tertiary trend.

The significant discovery on this trend in 2006 was BP's **Kiskida (diamond)** well, located in 1791 meters of water; this encountered 244 meters of net Lower Tertiary pay; the two wells are 130 kilometers apart.

Reference

St. John, Bill, A.W. Bally, and H.D. Klemme, 1984, Sedimentary provinces of the world – hydrocarbon productive and nonproductive (map with booklet): AAPG.