

## **Exploration, Appraisal, and Development of Turbidite Reservoirs in the Western Atwater Foldbelt, Deep Water Gulf of Mexico**

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The Western Atwater Foldbelt (WAFB) in the deep water Gulf of Mexico has yielded several large oil fields with a resource potential of more than two billion barrels. Oil has accumulated in Middle and Lower Miocene age submarine fan reservoirs draped over large, salt-cored faulted compressional anticlines and 3-way closures against salt /welds. The WAFB is producing more than 300,000 BOPD with a cumulative production of more than 150 million barrels of oil.

Early exploration in the WAFB focused on large compressional structures partially visible beneath the southern edge of shallow salt. BHP Billiton and BP formed a partnership leading to the trend-opening discovery on the Neptune structure in 1995 and major discoveries at Atlantis and Mad Dog in 1998. Subsequent discoveries have been made at K2 (1999), Shenzi (2002), Tahiti (2002), Puma (2003), Knotty Head (2005), Pony (2006), Friesian (2006) and Heidelberg (2009). As seismic imaging has continued to improve, exploration has focused on deeper subsalt targets. The exploration success rate in the WAFB about 33 %.

Exploration success in the WAFB has led to an extensive appraisal program to confirm the presence of economic resources. This has proved challenging due to the effect of shallow salt on seismic imaging leading to uncertainty on fault location and density. As a result, multiple appraisal wells are required for each structure. Appraisal drilling has added significant resources on the north side of Atlantis and the west and south sides of Mad Dog.

Initial production from the WAFB began at the Mad Dog Field in January 2005. Other fields that have come on production include K2 (May 2005), Atlantis (October 2007), Neptune (July 2008), Shenzi (March 2009), and Tahiti (May 2009). Early production data suggests the following:

- 1) Good initial production rates with many wells flowing at more than 20,000 BOPD.
- 2) More structural and stratigraphic complexity than expected.
- 3) Increased complexity challenges maintaining production rates.
- 4) Areas of poor subsalt seismic imaging has led to unexpected outcomes and sidetracking of some development wells.

Development wells are very expensive in the WAFB so it is important to use the learning's from early production to optimally locate future wells to efficiently drain the remaining resources in each field.