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Deepwater Nigeria OPL-213: An Exploration Risk Reduction Approach Using Integrated Geoscience Technologies

Introduction

The Texaco Nigeria Outer Shelf Ltd. deepwater Nigeria OPL-213 (100% WI) Odoguma and Aparo prospects (Figure 1) represent new play types in the deepwater. The technical evaluation identified main petroleum system risk elements and potential technical barriers to establishing high impact, commercially viable projects. Principal risks were identified as reservoir continuity and thickness, hydrocarbon phase and volumes, and lateral seal. An integrated, inter-disciplinary technology process was developed to focus on these critical elements.

Prospect Overview

Odoguma and Aparo prospects are each in the range of 200 to 500 MMBO recoverable reserve potential. Odoguma Prospect is a structural trap formed during the Early Oligocene to Recent through gravity-driven contractional duplexing of underlying Akata Formation shales. Multiple stacked Class III AVO anomalies correspond to L. Miocene to U. Oligocene channel-levee and slope fan reservoir objectives. Aparo Prospect is a stratigraphic trap formed by syntectonic deposition of Mid to Late Miocene reservoir targets. Each of the Aparo targets exhibits a low impedance and Class II AVO response.

Risk Reduction Technologies

Reservoir risk reduction was initiated through regional sequence stratigraphic studies designed to target sand-prone and laterally continuous reservoir facies. Reservoir geometries were mapped using StratiMagic software, Visualization technology for volume rendering, and Texaco's internal post-stack 'Sweetness' (post-stack instantaneous amplitude/frequency ratio) cubes. Acoustic and far-angle elastic impedance data from balanced seismic volumes and synthetic logs built from key offset wells formed the basis for sand thickness estimates. Exemplar forward numerical compaction modeling was used for calculating pre-drill reservoir properties.

Hydrocarbon phase was addressed first through use of surface piston core data with comparison to our regional reservoired oils database. AVA Triad Cluster Analysis in combination with fluid substitution and quantitative amplitude anomaly comparisons provided the basis for reservoired product phase and lateral distribution. Subregional 2D seismic and 2D basin modeling combined with 'critical moment' restored sections and fault seal studies addressed volume of available hydrocarbons and migration pathways.

Lateral seal risk reduction was addressed through mapping of onlap surfaces of potential reservoir units and through use of the fault application program 'FAPS' to measure the sealing capacity of key trapping faults. These analysis were combined with 2D pressure profiles and regional capillary pressure measurements to constrain hydrocarbon column heights.

Conclusions

Integration of geoscience technologies and application to specific risk elements resulted in substantial prospect risk reduction. Similarly, the range of uncertainty in potential prospect reserve sizes has been reduced, and strongly indicates we are focusing on prospects with high impact, commercial potential. The first measure of the success of the risk reduction process will be in 2001 with the drilling of the Odoguma #1 well.

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Biographical Sketches

R. K. SAWYER received a MS in geology from University of Florida in 1982. He has held a variety of exploration assignments since joining Texaco in 1982. Mr. Sawyer has authored or co-authored 15 sedimentology and structural articles covering the Florida Everglades basin, West Timor Indonesia, the western Sichuan Longmenshan mountains, southcentral Italy, and deepwater Niger Delta. He is presently assigned to Texaco's Deepwater Nigeria Team.

DAVID L. CONNOLLY received a BS in geology from Washington and Lee University in 1973. He started his career with Schlumberger and joined Getty/Texaco in 1981 and was assigned to the Gulf of Mexico division. David has been part of Texaco's deepwater Nigeria exploration team since 1993.

ARNAUD G. PICHON received a MS in geological/mining engineering from E.N.S. Geologie in Nancy, France in 1980, and worked with Elf-Aquitaine from1980 to 1997. His work experience includes exploration assignments in Nigeria, Norway, France and the U.S.A. and has been working with Texaco's deepwater Nigeria exploration team since 1997.

RAYMOND J. FONTENOT received a BS degree from University of Southwest Louisiana in 1981. Until 1999 when he joined Texaco's deepwater Nigeria exploration team, his exploration experience was focused on onshore/offshore Texas and Louisiana, and deepwater Gulf of Mexico. □

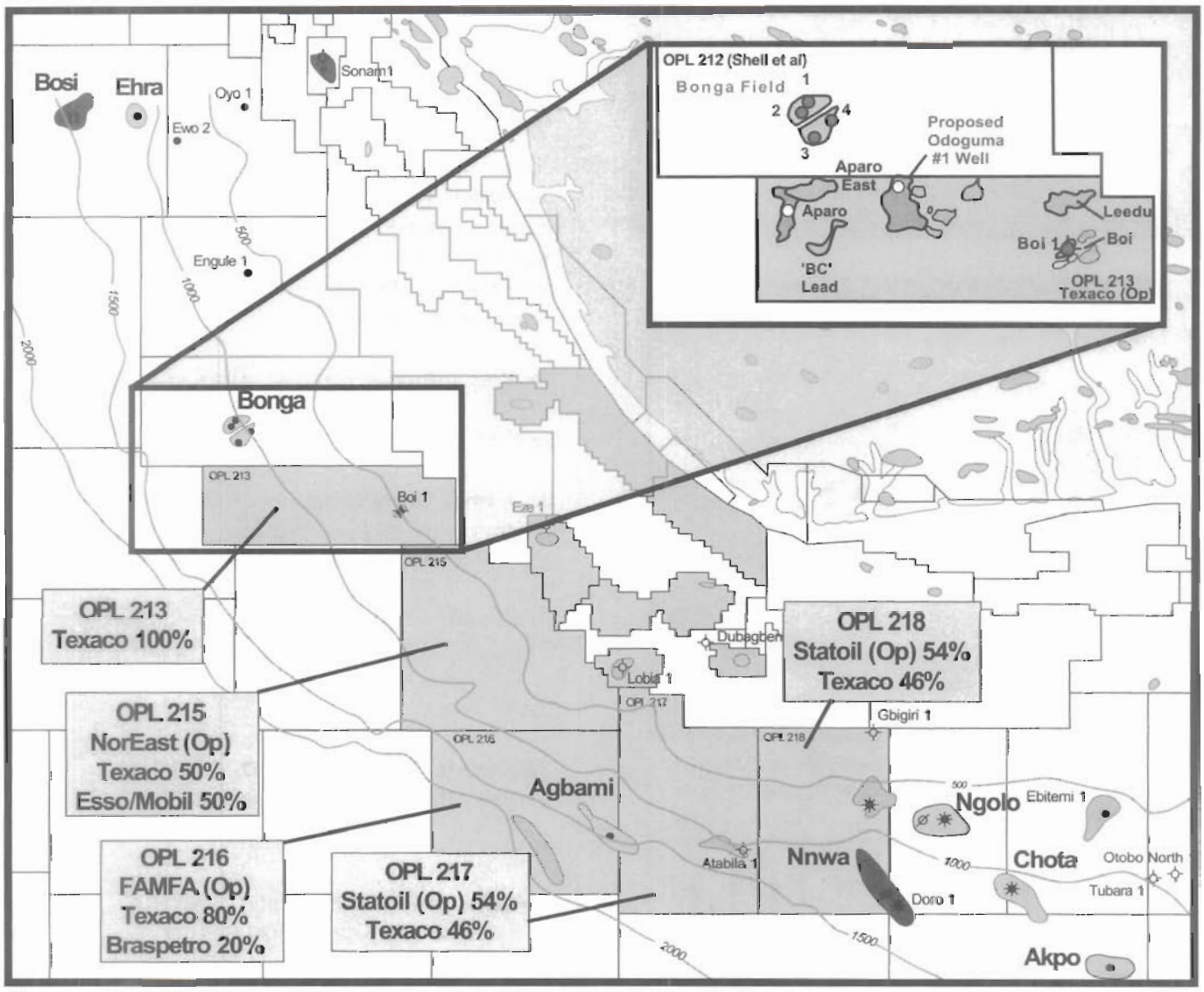

Figure 1. *Texaco deepwater Nigeria position with location of OPL-213 prospects and leads.*