**AV Northern Mozambique: True “Wildcat” Exploration in East Africa**

Carol Law

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1 Anadarko Petroleum Corporation, Houston, Texas (carol.law@anadarko.com)

**Wildcat Success Story**

Four Major discoveries
- Lagosta--550 net feet of pay
- Barquentine--416 net feet of pay
- Windjammer--555 net feet of pay
- Tubarao--110 net feet of pay

2011 Planned Activity
- Dedicated rig
- Second rig in fourth quarter
- Appraise discoveries
- Continue exploration program

**Project Execution**

One onshore and six deepwater wells were drilled in the last 15 months; they were intentionally different.
- Mecupa--onshore extensional play (gas shows)
- Windjammer--Area 1 Palma foldbelt [thrust play (gas discovery)]
- Collier--Area 1 Linique foldbelt [thrust play (TD’d due to mechanical difficulties)]
- Ironclad--Area 1 Undeformed Cretaceous [deepwater fan system Linque foldbelt (oil & gas shows]
- Barquentine--Area 1 Undeformed Oligocene/Paleocene [deepwater fan system Palma foldbelt (gas discovery]
- Lugosta--Area 1 combination structural-stratigraphic play (gas discovery)
• Tubarao--Area 1 Eocene slope channel play (gas discovery)

Reference

Northern Mozambique: True “Wildcat” Exploration in East Africa
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Thanks to:

• Mozambique Area 1 Partners: BPRL, Cove Energy, Mitsui, Videocon and ENH

• The Team at Anadarko Mozambique Area 1 Lda
  John Peffer, Rick Harlan, Assif Mussa, Mario Rassul, Abeda Remane, Alan Watts, + all local staff

• The Current Houston-Based Mozambique Team:
  Scott Birkhead, Tom Fletcher, John Hagens, Adam Heffernan, David Jones, John Kamm, Fiona Kilbride, Sean McPherson, Matt Morris, Don Sparling, Martin Tracy

Anadarko's Exploration Technology organization

• All of the Houston-based support organizations

• “Ghosts of Christmas” “Past”
  • specifically Ian Cooling, Brian Frost, & Andrew Mehlhop
APC’s East Africa Deepwater Acreage

Kenya
- 5 Deep Water Blocks
- 7.5MM Acres (equal to ~1,500 GOM Blocks)
- APC Operator - 70%
  Dynamic E&P
  Cove Energy

Mozambique
- Onshore and
  Area 1 Rovuma Blocks
- 6.3MM Acres (equal to ~1,300 GOM Blocks)
- APC Operator of both - 42%
  Onshore partners: Artumas, Cove, ENH, and M&P
  Area 1 partners: Bharat, Cove, ENH, Mitsui, Videocon
Northern Mozambique
True Wildcat Exploration in East Africa

- Where Are We?
- Why Mozambique?
- Where We Were
- Then and Now
- G&G
- Project Execution and Results
- A “Conde’ Nast” Travel Guide look at Mozambique
- Q&A
Mozambique – Where Are We
Maputo to Pemba
1652 km

Where are we?

Capital city and Main AMA1 office
Where are we?

Nearest deepwater port and commercial airport. Shore base is located here.
General

- **Large country 1,200 miles in length**
- **Population: ~22 million**
- **20% live in the northern portion**
- **80% of the population is agrarian**
- **Electricity available to ~10%**
- **Most industrial areas in south**
- **Per capita GDP ~$900/yr – relatively low literacy rate**

Oil & Gas

- **No current oil production in country**
- **2 producing gas fields in South**
- **APC Windjammer, Barquentine, Lagosta and Tubarao gas discoveries**
- **and oil shows at Ironclad**
Why Mozambique?

Rovuma Tertiary Basin

What Did the New Ventures Team See:

- Area 1 Offshore acreage lies within core of an unexplored Tertiary depocenter
- Analogous to World-Class Basins including the Niger Delta
- Karoo Play to the South
In the last 200 million years the Rovuma Delta area has:

- Moved from ~40°S to ~10°S Latitude
- Been the core of a supercontinent,
  A strike-slip margin, and a passive continental margin
- Undergone multiple phases of rifting

Modern East Africa Stratigraphy & Structure are the result of a very active and complex tectonic history
Onshore and Offshore Area 1 Exploration Phase 1 Timeline

What we committed to:

- Offshore Area 1 permit awarded
- Onshore Rovuma 2D seismic
- 3D Offshore Seismic
- 2D deep water seismic program
- Onshore Block well
- Area 1 6 Wells
- Area 1 Phase I Expires
- Offshore Area 1 permit awarded
- Onshore Rovuma Blk permit awarded
- 2D shallow water seismic program
- Onshore Block Phase I Expires
- Appraisal / Exploration
Project Challenges

Frontier Area

- Limited infrastructure
- Remote location impacts
- Local hire / local content
- Health care / security

Commercial

- Government
- Partner alignment
- Execution
- Field performance
- Product markets
- Environmental considerations
Then and Now: G&G Database

2007 Existing Database
- 2475 km on Area 1
- 1460 km 2D Onshore
- Data from 2 Onshore Wells

2008 Acquisition
- 3300 sq km 3D ($53MM)
- 465 Km 2D deepwater
- 642 km 2D land areas ($40MM)
- Traded for data from 3 Mnazi Bay wells

2009 Acquisition
- 2000 km 2D <50m WD
- 2900 km 2D >50m WD ($10MM)

Q4 2009 / to date
- 1 Onshore Well
- 6 Deepwater Wells

Mnazi-1
Mocimboa-1

Barquenteine-1
Windjammer-1
Mecupa-1
Lagosta-1
Tubarao-1
Collier-1
Ironclad-1
Then and Now: Leads & Prospects

2007

Northern Mozambique & Southern Tanzania
Digital Elevation & Relief Image

Mozambique Leads and Prospects - 12 July 2010

2010
Numerous potential trap types (optionality)

- Identified seven independent plays
  (Drilled Five play types to date)

- Geophysical Anomalies (potential predictability)

- Running room (upside)
G&G: Structural Domain

Classic example of linked extensional-contractional system

APC Blocks
Extensional domain: sharp lateral boundaries, faults terminate at lateral boundary.

In La Conchita, CA, landslide and debris flow occurred in the spring of 1995. Many people were evacuated because of the slide and the houses nearest the slide were completely destroyed. Fortunately, no one was killed or injured. (Photo by R.L. Schuster, U.S. Geological Survey, landslides.usgs.gov)
G&G: Detachment Structure (TVDSS, m)

- Palma Fold belt
- Lunique Fold Belt

Extension

Contraction
G&G: Regional Strike Line XL 1600

Lunique FB

Palma FB
G&G: Palma Foldbelt Dip Section

“Master Detachment”

“Deep Horizon”
Project Execution and Results
Offshore Mozambique
Wildcat Success Story

4 Major Discoveries
- Lagosta - 550 Net Feet of Pay
- Barquentine - 416 Net Feet of Pay
- Windjammer - 555 Net Feet of Pay
- Tubarão - 110 Net Feet of Pay

2011 Planned Activity
- Dedicated Rig
- Add Second Rig in Q4
- Appraise Discoveries
- Continue Exploration Program

Robust Exploration Inventory
Drilled 6 Deep Water wells in the last 15 months: Intentionally very different

- **Mecupa** - Onshore Extensional Play (*Gas Shows*)
- **Windjammer** - Area 1 Palma Foldbelt Thrust Play (*Gas Discovery*)
- **Collier** - Area 1 Linique Foldbelt Thrust Play (TD’d due to mechanical difficulties)
- **Ironclad** - Area 1 Undefomed Cretaceous Deepwater Fan System Linque Fold Belt (*Oil & Gas shows*)
- **Barquentine** - Area 1 Undefomed Oligocene / Paleocene Deepwater Fan System Palma Fold Belt (*Gas Discovery*)
- **Lagosta** - Area 1 Combination structural stratigraphic play (*Gas Discovery*)
- **Tubarao** - Area 1 Eocene slope channel play (*Gas Discovery*)
Mecupa Tertiary Extensional Play

- **Onshore Rovuma Delta**
  - Nearest offset wells = Mocimboa 1 (53 km), Mnazi Bay 1 (70 km)
  - Sparse 2D seismic (3-5km line spacing)

- **Tertiary section characterized by listric growth faults and regional detachment**
  - Ties to offset wells required jump-correlating based on seismic character

- **Objective = seismic amplitude package interpreted to be sandy**

- **Structure = 4-way rollover into listric growth fault**
  - mapped primarily on 2 key dip lines and 1 key strike line
  - Well location on strike line, constrained by surface drainage
Mecupa Post-drill Summary

Well Results

- **Reservoir**
  - Thick, High Quality Reservoir Sands

- **Structure**
  - Dip data roughly consistent with original structural interpretation
  - ~200m shallow to prognosis
  - Multiple small-scale faults not previously interpreted
  - Late-stage fault movement?

- **Hydrocarbons**
  - Significant gas shows
  - 0.6m gas “pay” in thin sand

- **Stratigraphy**
  - Gross lithology prediction from seismic validated
  - Expanded lower Miocene section
Windjammer 1st Deep Water Well Gas Discovery

484 feet net gas pay in Oligocene

Gross Column > 1200”

Oligocene Fan 1
320” (97.54m) sd
258” (78.64m) pay

Oligocene Fan 2
273” (83.43m) sd
163” (49.53m) pay

Repeated
Oligocene Fan 2
135” (41.27m) sd
63” (19.2m) pay

Paleocene
Gross: 472” (144 m)
Net Sand: 371” (113 m)
Net Pay: 76” (23 m)

Total Windjammer Pay
564 feet (172 meters)

Anadarko Tower
Woodlands Texas
No hydrocarbons were logged or recovered → primary risk pre-drill was identified as containment and was considered post-drill to be the failure mode.

The Oligocene Fan--turned out to be Paleocene age, excellent recalibration of seismic interpretation in the Linique Foldbelt and southern end of block

Temperature consistent with Windjammer; began to get a regional understanding of thermal regime for petroleum systems modeling
Ironclad Cretaceous Fan Play

Ironclad-1 5129 m

125" (38m) Oil and Gas Shows
In tight Cretaceous DW sands
Barquentine Oligocene & Paleocene DW Fans

Dipline Through Windjammer and Barquentine

Total of 416 feet (127 m) gas pay

308 feet (94 m) in Oligocene
180 feet (55m) in Paleocene
Lagosta Oligocene & Eocene Deepwater Fans

- Section Length: 27 mi
- Total of 550 feet (168 m) gas pay
- 374 feet (114 m) in Oligocene
- 177 feet (54 m) in Eocene

Layers:
- PALEOCENE
- DEEP EOCENE
- SHALLOW EOCENE
- OLIGOCENE FAN 1
- OLIGOCENE FAN 2
- OLIGOCENE MARKER

Locations:
- WINDJAMMER
- BARQUENTINE
- LAGOSTA
**Tubarao Eocene Slope Channel**

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<th>South</th>
<th>Strike View</th>
<th>North</th>
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<td><strong>Tubarao #1</strong></td>
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<td><strong>Total of 110 feet (34 m) gas pay</strong></td>
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<td>In Eocene Slope Channel sands</td>
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*Images of geological structures and fold belts.*
Mozambique: Building On Success

- Acquire and Evaluate 3D
- Integrate Well Results
- Extend Gas Play
- Test New Concepts
- Evaluate Liquid Targets
Thank You!