I.E.N.E. E&P Conference

PLANNING FOR THE GREEK LICENSING ROUND

Dr KONSTANTINOS A. NIKOLAOU
Petroleum Geologist – Energy Economist
General Director KANERGY Ltd (kanergy@otene.gr)
Ex. Technical Advisor ENERGEAN OIL & GAS
Ex. Technical Director of HELLENIC PETROLEUM SA

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Exploration Activity in Greece - Current Status

- After 15 years of inactivity, establishment of the Hellenic Hydrocarbons Management Company S.A., 2011
  (organize, execute exploration and/or production tenders, evaluate offers, select winners, prepare contract agreements and constantly supervise appropriate execution)
- Tender for non-exclusive seismic surveys. Final proposals on the second day of March 2012
- Decision is expected within the second quarter of 2012
Greece: First “Open Door” Exploration Areas

Areas integrated in the process “open door”

- Gulf of Patras
- Epirus – Ioannina
- Western Katakolo

Offers are expected on July 2, 2012
MAIN ISSUES THAT NEED ANSWERS

• Are there proven or potential petroleum systems?
• Is there any Hydrocarbon potentiality?
• Are there credible analogues?
• Are the Blocks attractive for Oil companies?
• Is the time enough to promote the "open door" tender?
• Is the business environment the proper one?
PETROLEUM SYSTEM
“The main Conditions for hydrocarbons existence”

- SOURCE ROCKS (quantity, quality, maturity, migration)
- RESERVOIR ROCKS (porosity, permeability)
- TRAPS
- SEAL ROCKS
- APPROPRIATE GEOLOGICAL TIME

• Possibility Of Success (POS) %

Analogues ???
ΕΡΕΥΝΑ και ΕΞΕΡΕΥΝΗΣΗ Υ/Α VS RESEARCH-EXPLORATION H/C

ΕΡΕΥΝΑ / RESEARCH= Parts and Segments of Exploration of H/C:
Geological, geochemical, geophysical, engineering etc, studies and research. Made by oil companies or E&P Service Companies, Laboratories, Universities, Institutes, Researchers, Consultants etc

ΕΡΕΥΝΑ / EXPLORATION= Geology - Geophysics – Geochemistry
Drilling - Development and Production

Required:
- Licenses and contacts
- High Risk Investments
- Limited contract Time !!!
- Economics

MANAGEMENT and OPERATION BY OIL COMPANIES
The History of Exploration Activity in Greece before 60’s
More than 40 wells in areas with gas and oil surface shows

ZAKYNTHOS
HERODOTUS, 480 BC

KATAKOLON “Volcano” 1976

KATAKOLON “Volcano” 2004

DRAGOPSA - EPIRUS

SMOLITSAS - EPIRUS

LOUTRA KYLLINIS
The History of Exploration Activity in Greece Early 60’s to mid 70’s

- **OPERATORS**
  - Former Ministry of Industry
  - Institute of Geology and Mineral Exploration (IGME)
  - Institute Francais du Petrol (IFP)
  - International oil companies

The final result of the exploration that took place during that time was the discovery of the first exploitable hydrocarbon reserves in the off-shore area of Thasos island (Prinos oil-field and South Kavala gas-field) by OCEANIC (1971-1974).

- 40 wells drilled in total
- Encouraging HC indications
- Improvement of geological background
The History of Exploration Activity in Greece - Mid 70’s to mid 90’s

- 1975 - foundation of the Public Petroleum Corporation (DEP)
- 1985 – foundation of (DEP EKY (subsidiary company to DEP)
- The Greek government granted to the aforementioned two companies 24 on-shore and off-shore areas for HC prospecting, exploration and production
- Total of 73,000 Km of 2D and 300 km² of 3D seismic surveys
- 74 exploration wells were drilled
- 1998-99 foundation of Hellenic Petroleum
The History of Exploration Activity in Greece Mid 90’s to mid 00’s

- 1996- 1st International Licensing Round, involving 6 concession areas
- 4 licenses were granted for the areas:
  - NW Peloponnese & Ioannina (Enterprise Oil)
  - Aitolokarnania & off-shore Western Patraikos Gulf (Triton Ltd)
- Total amount of investment in seismic surveys and drilling reached up to 85 M€.
- All wells were P&A with minor HC shows.
- Acquisition of Triton Ltd by Amerada Hess and acquisition of Enterprise Oil by Shell and the companies withdrew in 2000-2001. (low oil prices)
Greece: Geological Summary of the External Geotectonic Zones of W. Greece

Northern Ionian cross section and potential plays

Simplified lithostratigraphic column with main reservoir & source rocks

Central Ionian cross section and potential plays
### Oil Groups of Western Greece

<table>
<thead>
<tr>
<th>GROUP</th>
<th>GEOTECTONIC ZONE</th>
<th>AREA</th>
<th>SOURCE ROCK</th>
<th>AGE</th>
<th>OIL WINDOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (A1-A2)</td>
<td>CENTRAL IONIAN</td>
<td>EPHRUS @ OTSARA</td>
<td>POSIDONIA BEDS</td>
<td>MIDDLE JURASSIC</td>
<td>3750-5800 m</td>
</tr>
<tr>
<td>B</td>
<td>CENTRAL IONIAN</td>
<td>TRIKOS KYLLINI W. KATAKOLO</td>
<td>VIGLA SHALES</td>
<td>LOWER CRETAUCEOUS</td>
<td>3450-5600 m (central Ionian)</td>
</tr>
<tr>
<td>C</td>
<td>CENTRAL IONIAN</td>
<td>DELVINAKI S. KATAKOLO ETOLIKO-1</td>
<td>TRIASSIC BRECCIAS</td>
<td>TRIASSIC</td>
<td>1000-3000 m</td>
</tr>
<tr>
<td>D1</td>
<td>PAXI</td>
<td>ZANTE</td>
<td>CLASTIC SEDIMENTS</td>
<td>MIocene</td>
<td>5000-7850 m</td>
</tr>
<tr>
<td>D2</td>
<td>GAVROVO</td>
<td>FILIATRA</td>
<td>EVAPORITES</td>
<td>MIocene</td>
<td>5000-7850 m</td>
</tr>
<tr>
<td>E</td>
<td>PAXI</td>
<td>PAXI ISLAND</td>
<td>APTIC SHALES</td>
<td>M-J JURASSIC</td>
<td>5600-7250 m</td>
</tr>
</tbody>
</table>

### Source Rocks and oil seeps in Western Greece

**Lower Posidonia beds**

- **Loutra Kyllinis oil seep**
- **Zakynthos: Miocene source rocks**
- **HERODOTUS OIL SEEP**
- **Dragopsa Oil Seep**
Synthetic sketch map showing Italian and Albanian hydrocarbon plays with an attempt for correlation with the northwestern part of Greece.
Carbonate platform margin “build-ups” in the Adriatic Sea in ITALY

Analogues: South Adriatic in Italy and North Ionian in Greece

1. Platform margin build-ups (Giove, Medusa discoveries)
2. Pelagic Carbonates – Paleo-structures (Rovesti discovery / Aquila field)
3. Proximal Talus Slope Play
4. Platform Rotated Fault Blocks (Cretaceous/Jurassic)
5. Distal Calcarenite Turbidades (re-sedimented platform carbonates – Aquila field)

West Lefkas - Reefal build-ups in Greece

West CORFU: Faulted Block (possible “paleo-high”)
N-S directed seismic line

West CORFU: 400 sq. Km structure

Neogene

MESOZOIC
Available Data
2 D Seismic 1015 km, (408 km by Enterprise Oil).
Wells: 11 (Enterprise Oil 1 and 1 side track)
(Demetra # 1, 3966 μ and 1 site track till 3600 μ)
Summary of Demetra-1

- Drilling started 8/9/2001
- Top of Evaporites was @ 1897m
- Drilling through the evaporitic sequence up to 3996m (85 days) where really high pressures occurred (kick, 16.5 ppg).
- Due to technical reasons (increase of mud weight), drilling stopped, well cemented up to 3.076m and sidetracked

Summary of Demetra-1z

- Well was sidetracked from 2807m
- @ 3566m high pressures occurred (17.5 ppg)
- Increase of mud weight at 17.9 ppg
- Drilling stopped @ TD of 3600m after 162 days

DLV-1

- Analogue well with high pressures in the region
ANALOGUES and HYDROCARBON OCCURRENCES IN ALBANIA

(OIL & GAS FIELDS)

GORISHTI Field

Structural section across NW. Greece
OFFSHORE WEST KATAKOLON FIELD AS A KEY CASE

The field discovered in 1981, and the producing horizon is the Eocene-Cretaceous carbonates of a paleostructure, unconformably covered by clastic Neogene sediments with an estimated 20-25 million bbl oil in place.

• West Katakolon oil field has been proved by 3 wells WK-1, WK-1a and WK-2 (1981-1982)
• Different production performance was recorded
  ▪ In WK-1a Gas flowed from two layers in the Gas Cap with flow rates up to 11MMSCFD from each zone.
  ▪ In WK-2 oil flowed from two zones with flow rates between 1000-1400 bbl/day each. Gas zone was not reached at this position
Greece: Exploration Potentiality of Katakolo Oil Field

Schematic Geological Interpretation

Oil Column 87m
W. Katakolo As a key case
[field geoseismic section (based on 2D profiles)]
Gulf of Patras

Block History

- 2D seismic data were acquired before 1982
- Modern seismic data acquired in 2000 by Triton Hellas
- Both surveys have been reprocessed
- 3 shallow (around 1200m) wells drilled within the concession area
Overall the area can be considered very interesting.

- Good quality of existing data however a detailed re-evaluation is needed.
- Echo prospect is the main target but there are secondary targets as well.
TECTONIC SKETCH OF EASTERN MEDITERRANEAN

NORTH IONIAN SEA
(SOUTH ADRIATIC/APULIAN PLATFORM)

CENTRAL IONIAN SEA
(KATAKOLON - PATRAIKOS GULF)

SOUTH IONIAN and
SOUTH CRETE AREA
???
EAST MEDITERRANEAN SUB-BASINS
ISRAEL: Offshore Discoveries in Levantine Basin

Egytpt: Offshore discoveries in Eastern Mediterranean

Cyprus A
7 + Tcf

Leviathan
≈ 16 + Tcf

Tamar
≈ 8+ Tcf

Dalit
≈ 0.5 Tcf

Seismic Section and Discoveries from Cyprus to Israel
Greece: Exploration Potentiality of Southern Crete

General Geological Model

Prospective Area

Huguen et al (2001)
PETROLEUM SYSTEM and POSSIBILITY OF SUCCESS (POS-%)
Examples from Patraikos Gulf and the area South of Crete

<table>
<thead>
<tr>
<th>Elements of Petroleum System</th>
<th>Patraikos Block</th>
<th>South of Crete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Reservoir</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Trap</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Seal</td>
<td>0.7</td>
<td>0.4</td>
</tr>
<tr>
<td>Migration (timing)</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Possibility Of Success</td>
<td>≈ 10 %</td>
<td>&lt; 3 %</td>
</tr>
<tr>
<td>Estimated Drilling Costs</td>
<td>$30MM</td>
<td>$100MM</td>
</tr>
</tbody>
</table>
ΥΠΟΣΤΗΡΙΚΤΙΚΑ
# Petroleum Resources Classification

**ΠΑΡΑΓΩΓΗ (PRODUCTION)**

**ΑΠΟΘΕΜΑΤΑ (RESERVES)**

- **Βεβαιωμένα (Proved)** 1P
- **Δυνατά (Probable)** 2P
- **Πιθανά (Possible)** 3P

**ΔΥΝΗΤΙΚΟΙ ΠΟΡΟΙ (CONTINGENT RESOURCES)**

- **1C**
- **2C**
- **3C**

**ΜΗ ΑΠΟΛΗΨΙΜΑ (UNRECOVERABLE)**

**ΑΝΑΜΕΝΟΜΕΝΟΙ ΠΟΡΟΙ (PROSPECTIVE RESOURCES)**

- **Συντηρητική Εκτίμηση (Low Estimate)**
- **Μέση Εκτίμηση (Best Estimate)**
- **Υψηλή Εκτίμηση (High Estimate)**

**ΜΗ ΑΠΟΛΗΨΙΜΑ (UNRECOVERABLE)**

**Αύξηση Πιθανότητας Εκμετάλλευσης (Increasing Chance of Commerciality)**

**Βαθμός Αβεβαιότητας (Range of Uncertainty)**