PLANNING FOR THE GREEK LICENSING ROUNDS

Dr KONSTANTINOS A. NIKOLAOU
Petroleum Geologist – Energy Economist
General Director KANERGY Ltd (kanergy@otenet.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 2-ond day of March 2012, 8 companies bid
- Decision is expected within the 2-ond Quarter of 2012
Greece: First “Open Door” Exploration Areas

Areas integrated in the process “open door”

- **Gulf of Patras**
- **Epirus – Ioannina**
- **Western Katakolo**

External Hellenides geotectonic zones

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

• Are there proven or potential petroleum systems?
• 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?
TECTONIC SKETCH OF EASTERN MEDITERRANEAN

NORTH IONIAN SEA
(SOUTH ADRIATIC/APULIAN PLATFORM)

CENTRAL IONIAN SEA
(KATAKOLON - PATRAIKOS GULF)

SOUTH IONIAN and SOUTH CRETE AREA

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Tectonic sketch of the Eastern Mediterranean
(adapted from Barrier, E., Chamot-Rooke, N. and Giordano, G., 2004,
Geodynamic Map of the Mediterranean, Commission for The Geological Map of the World, CCGM)
The History of Exploration Activity in Greece before 60’s

DRIVERS: More than 40 wells in areas with gas or/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

- **40 wells drilled in total**
- **Encouraging HC indications**
- **Improvement of geological background**

**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 had taken 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).
GREECE: E&P Licenses to International Oil Companies (1968- July 1974)
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 and starting of privatization procedures of Hellenic Petroleum
- 2007: all licenses returned to the State

1981 Discovery of Katakolon Oil Field

1988 Discovery of Epanomi Gas Field
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)
  - Aitoloakarnania & 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 2001-2002. (low oil prices)
WESTERN GREECE

ALPINE

and

POST ALPINE BASINS

PETROLEUM SYSTEMS
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

Source Rocks and oil seeps in Western Greece

#### Lower Posidonia beds

<table>
<thead>
<tr>
<th>GROUP</th>
<th>GEOTECTONIC ZONE</th>
<th>AREA</th>
<th>SOURCE ROCK</th>
<th>AGE</th>
<th>OIL WINDOW</th>
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<tbody>
<tr>
<td>A</td>
<td>CENTRAL IONIAN</td>
<td>EPIRUS (BOTSARA)</td>
<td>POSIDONIA BEDS</td>
<td>MIDDLE JURASSIC</td>
<td>3750-5800 m</td>
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<td>CENTRAL IONIAN</td>
<td>TRIFOS KYLLINI W. KATAKOLO</td>
<td>VIGLA SHALES</td>
<td>LOWER CRETACEOUS</td>
<td>3450-5600 m (Internal Ionian)</td>
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<td>CENTRAL IONIAN</td>
<td>DELVINAKI S. KATAKOLO ETOLIKO-I</td>
<td>TRIASSIC BRECCIAS</td>
<td>TRIASSIC</td>
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<td>D1</td>
<td>PAXI</td>
<td>ZANTE</td>
<td>CLASTIC SEDIMENTS</td>
<td>MIocene</td>
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<td>D2</td>
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<td>FILIATRA</td>
<td>EVAPORITES</td>
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<tr>
<td>E</td>
<td>PAXI</td>
<td>PAXI ISLAND</td>
<td>APTICI SHALES</td>
<td>M-U JURASSIC</td>
<td>5600-7250 m</td>
</tr>
</tbody>
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**Loutra Kyllinis oil seep**

**Zakynthos: Miocene source rocks**

**HERODOTUS OIL SEEP**

**Dragopsa Oil Seep**
Analogues in...

Albania, Italy, Croatia and Montenegro
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 Turbidites (re-sedimented platform carbonates – Aquila field)

West Lefkas - Reefal build-ups In Greece

West CORFU: 400 sq. Km structure

West CORFU: Faulted Block (possible “paleo-high”) N-S directed seismic line
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)
ANALOGUES and HYDROCARBON OCCURRENCES IN ALBANIA
(OIL & GAS FIELDS)

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.
KATAKOLO: GAS SHOWS

"VOLCANO" gas shows

GAS SHOWS

KATAKOLO DISCOVERY
Greece: Exploration Potentiality of Katakolo Oil Field

Schematic Geological Interpretation

Oil Column 87m

OIL

GAS

WATER

EOC, Thin bedded limestone
Up. Cret. Carbonates & Cherts
Jr. Carbonates

Tr. Evaporites

SK-1

WK-2

Tr. Evaporites
W. Katakolo: As a key case and analogue
[field geoseismic section (based on 2D profiles)]

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Triassic Evaporites
Jurassic-Eocene carbonates
Oligocene Flysch
Upper Miocene
Lower Pliocene
Upper Pliocene-Pleistocene
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
Greece: Exploration Potentiality of Gulf of Patras

Play concepts (Triton Hellas)

- 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.

Map of potential leads (Triton Hellas 2000)

Play concepts (Triton Hellas)

- PATRAIKOS GULF: SEISMIC LINE WITH NEO-DIAPIRISM of TRIASSIC EVAPORITES
- Play concept K NIKOLAOU

Mesozoic Carbonates
Neocene
Plio-pleistocene
TR.-Ev

A B C D leads
Egypt: Offshore discoveries in Eastern Mediterranean

ISRAEL: Offshore Discoveries in Levantine Basin

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)