

# **GREECE AS AN EXPLORATION PLAY IN SOUTH EAST EUROPE**

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*(1) The Author express his own opinions*

# **GREECE : E&P SECTOR DEVELOPMENTS AT A GLANCE (I)**

- **1975: Establishment of the Public Petroleum Co of Greece (DEP S.A.) with dual role: State Business Unit for E&P, and Licensing Authority, acting on behalf of the Ministry.**
- **1986 Growth of DEP S.A. as a Holding Co, with Refineries, Retail, Gas, E&P, Engineering Companies as affiliates. Establishment of DEP-EKY to replace the original DEP for E-P.**
- **1998 Mergence of DEP companies and Creation of HELLENIC PETROLEUM SA . DEP-EKY became a directorate in H.P. Licensing Responsibilities and concessions for E&P, transferred to HELLENIC PETROLEUM.**
- **1998 Beginning of Privatization process of H.P.**
- **Share holders structure 2008 : Greek State 35,5 %, Strategic Investor 35,8%. The rest in Athens and London Stock Exchange.**

# **GREECE : E&P SECTOR DEVELOPMENTS AT A GLANCE (II)**

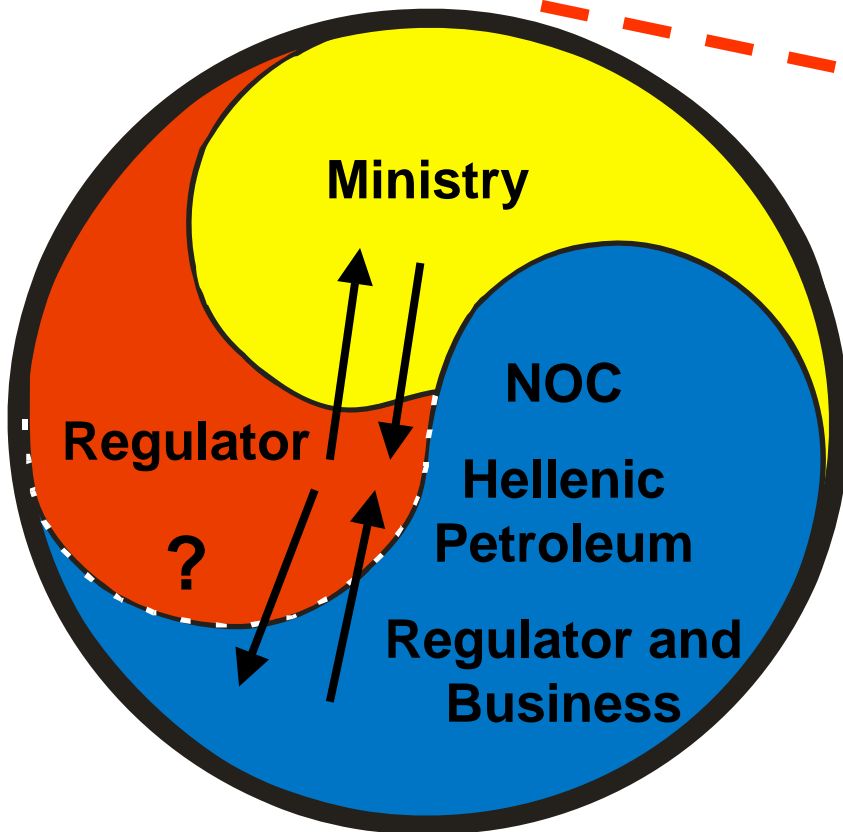
- **1976: Adoption of E&P basic Law (468/76) by the Greek Parliament**
- **1994: Adoption of E&P Directive by the European Parliament(22/94/EC)**
- **1995: Adoption of new E&P LAW (2289/95) by the Greek Parliament, to comply with the European Directive**
- **2007: The Greek State decided, to revoke the 24 E&P licenses, of about 60.000 sq. Km, awarded to DEP/DEP-EKY/H.P. between 1976-1998**
- **2008: A special E&P Licensing Authority, is to be established, separating the State role from H.P.**

# Greece: 2008

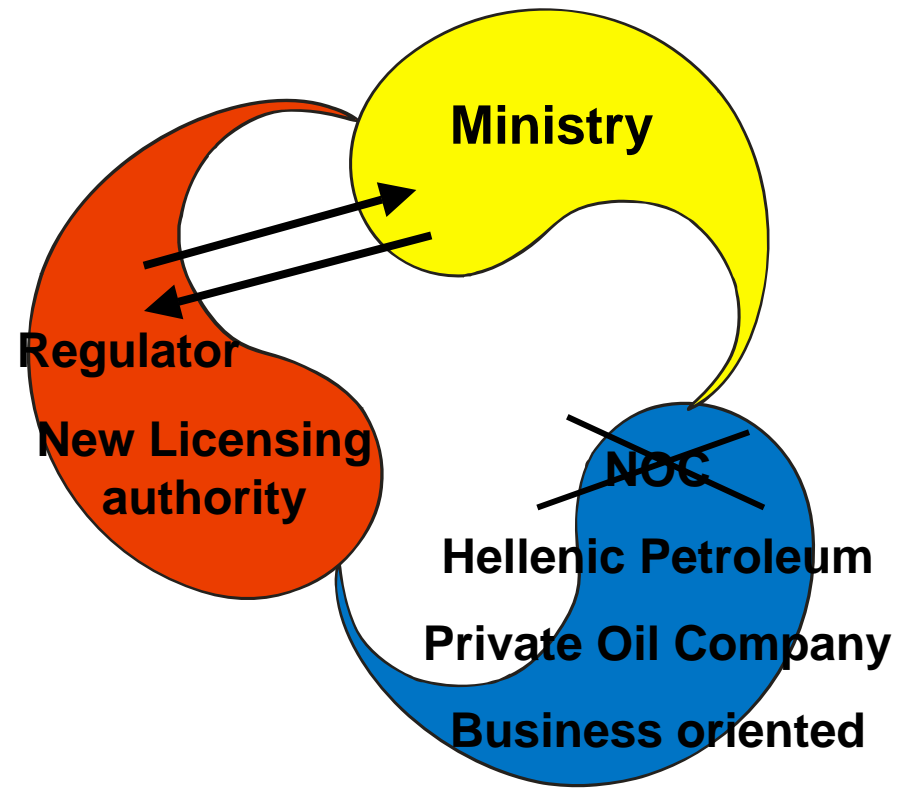
## New Developments in E&P Sector

*Fundamental principle is to Separate the Government Role from the Company one*

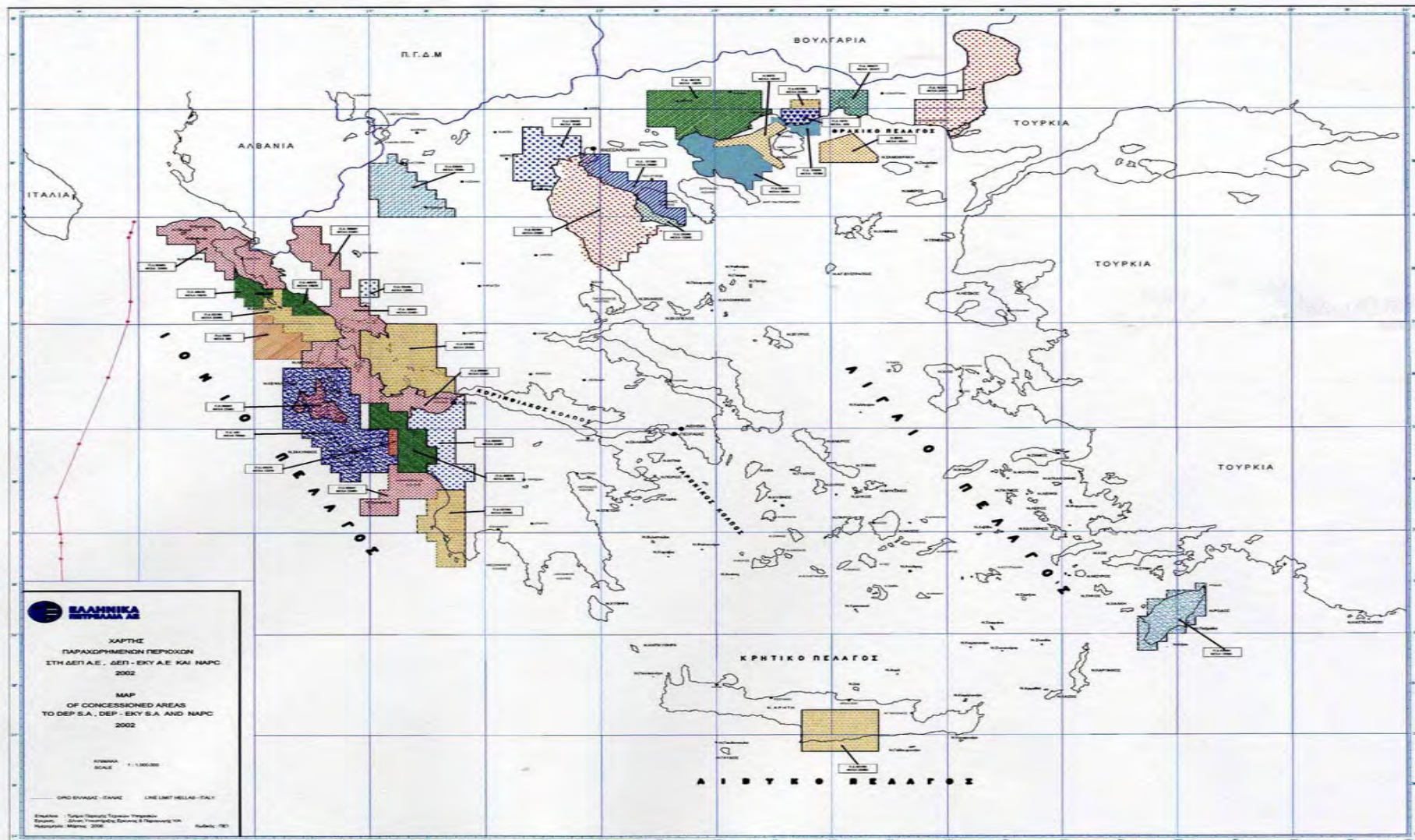
**BEFORE**



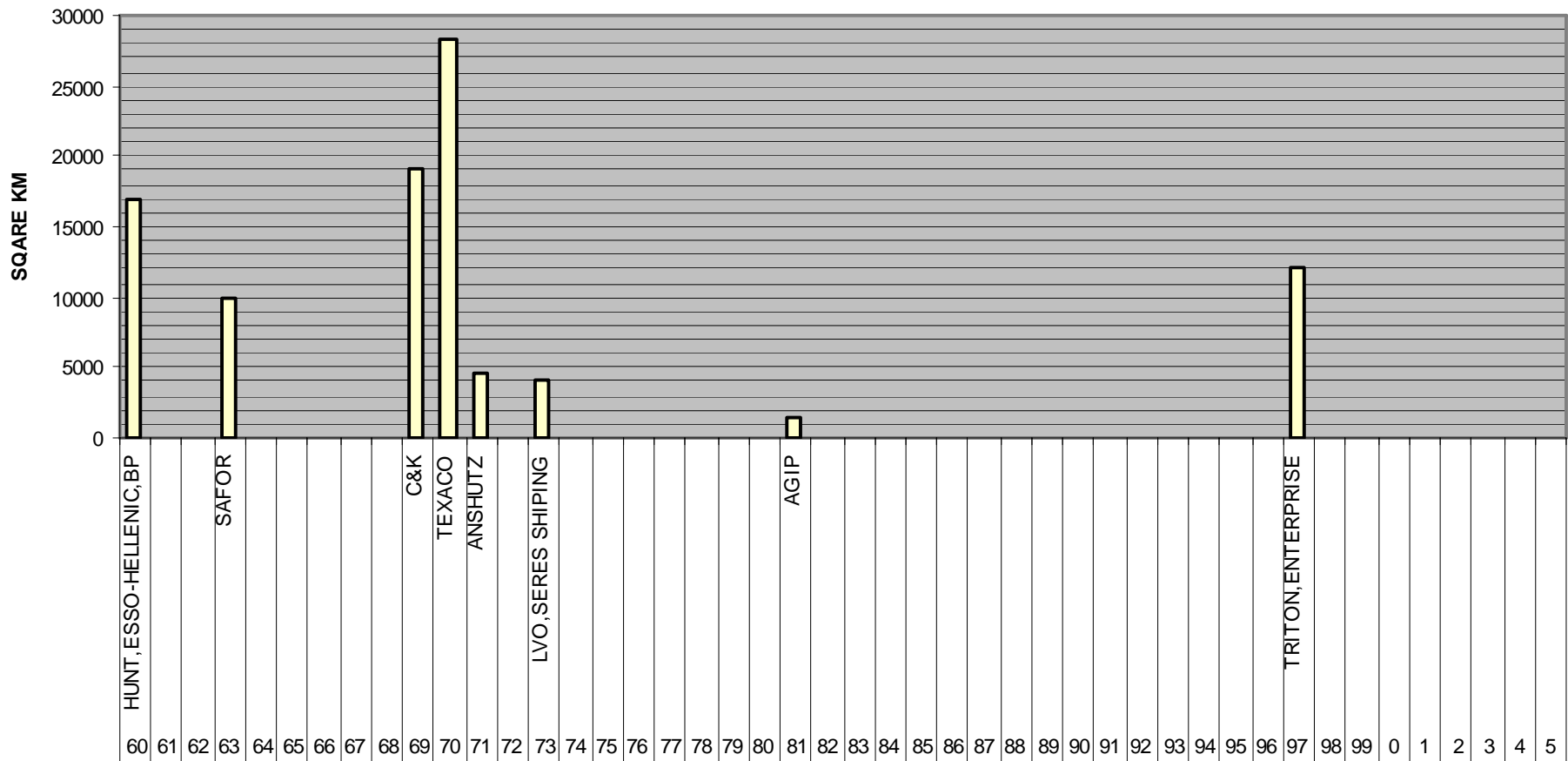
**AFTER**



# Concession areas in Greece that were granted to Hellenic Petroleum and have been returned to the State in July 2007



# E-P Licenses to international oil companies 1960-2005



# HELLENIC PETROLEUM UPSTREAM ACTIVITIES IN GREECE

- **Exploration activities include 76 exploratory wells and 53550 km 2D seismic, acquired mostly during late 70 's and early 80's**
- **A marginal offshore oilfield was discovered in Katakolo, W. Peloponnesus as well as a non commercial asphalt field in Zakynthos and an onshore marginal gas field in Epanomi, near Thessaloniki.**
- **Some Interesting biogenic gas accumulations were discovered while drilling Neogene layers.**

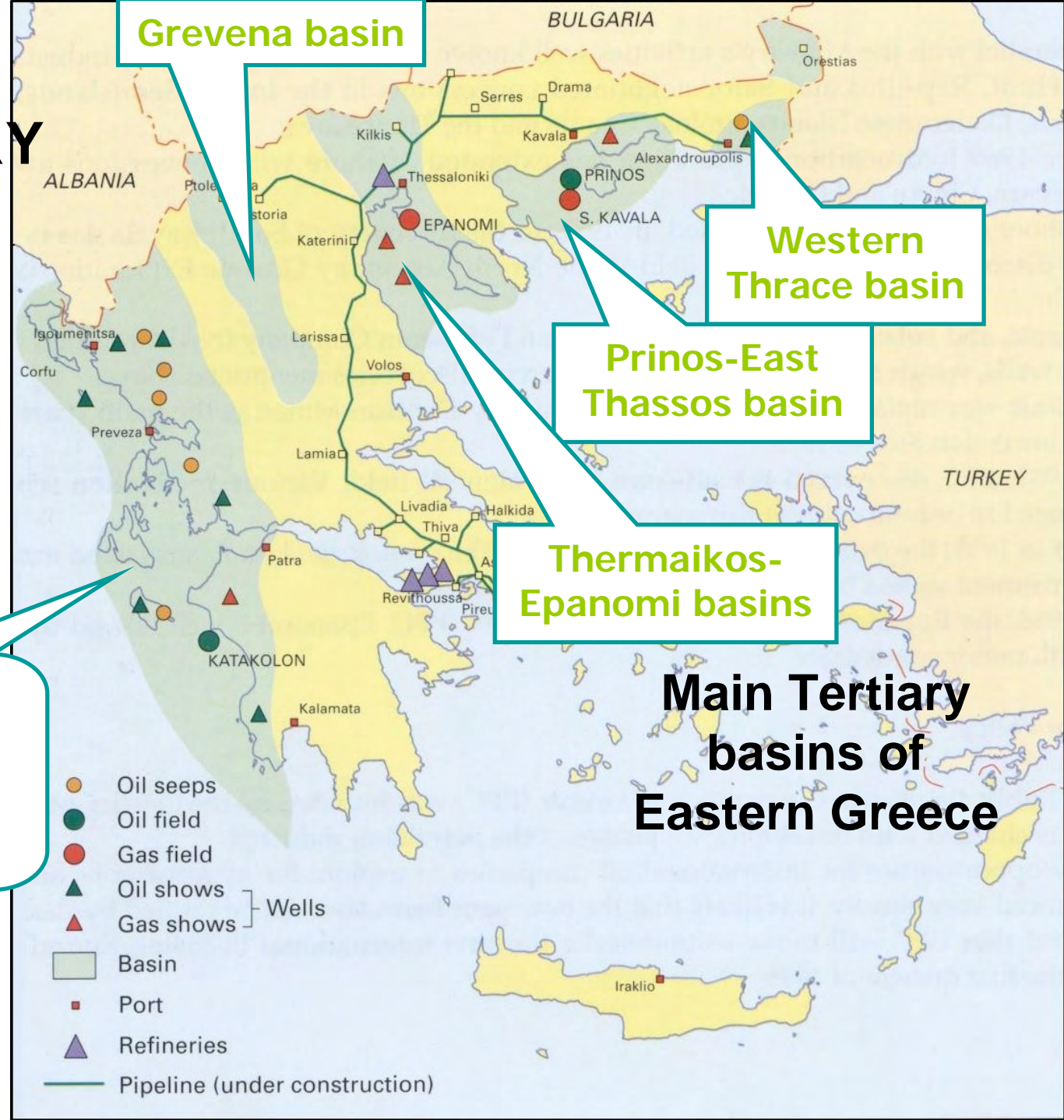
# HYDROCARBON SYSTEMS and H/C DISCOVERIES

The **answer** to the question whether or not Greece has any exploration and production potential for oil, is definitely **positive**. This because there are proven active petroleum systems in the alpine and Post-alpine basins of Western Greece, as well as, in the molassic and post-alpine tertiary basins of Eastern Greece, where source rocks, reservoirs, cap rocks and proper geological and migration timing **co exist**. The active hydrocarbon seeps and shows and hydrocarbon discoveries, found in both Western and Eastern Greece, attest to the existence of active hydrocarbon systems.



# GREECE SENTIMENTARY BASINS,

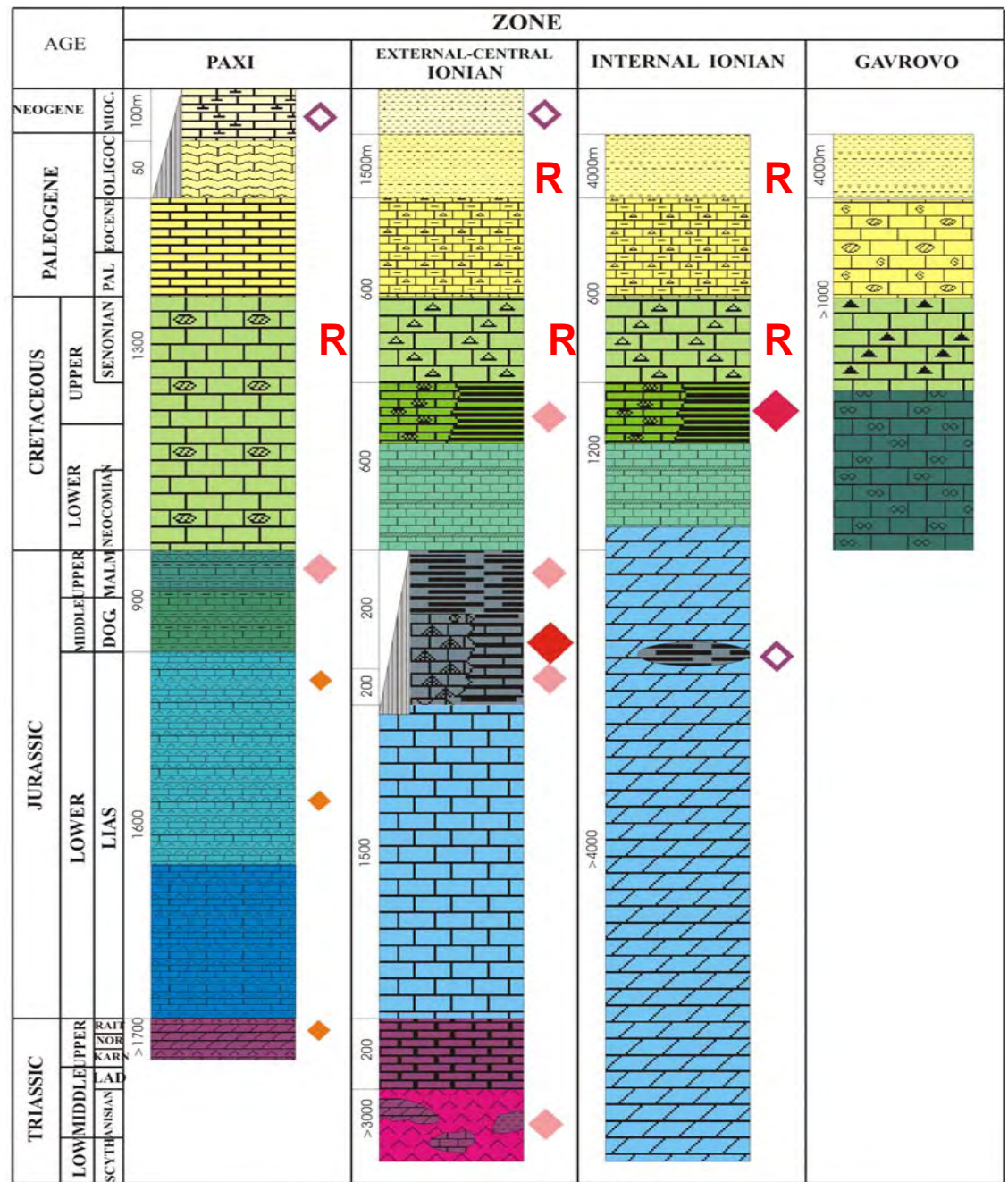
# Hydrocarbon Occurrences and infrastructures



# Simplified lithostratigraphic columns and main source and reservoir rocks intervals, of the external geotectonic zones in Western Greece

◆ Source rocks

R Reservoir rocks



SOURCE ROCK CHARACTERISATION

◆ VERY PROSPEROUS    ◆ PROSPEROUS    ◆ FAIR    ◆ POSSIBLE (EXPECTED)

# Lower Posidonia beds in Elataria-Epirus



**Brachyphyllum nepos SAPORTA**

# Loutra Kyllinis



# Katakolo «Volcano» Natural Gas Show

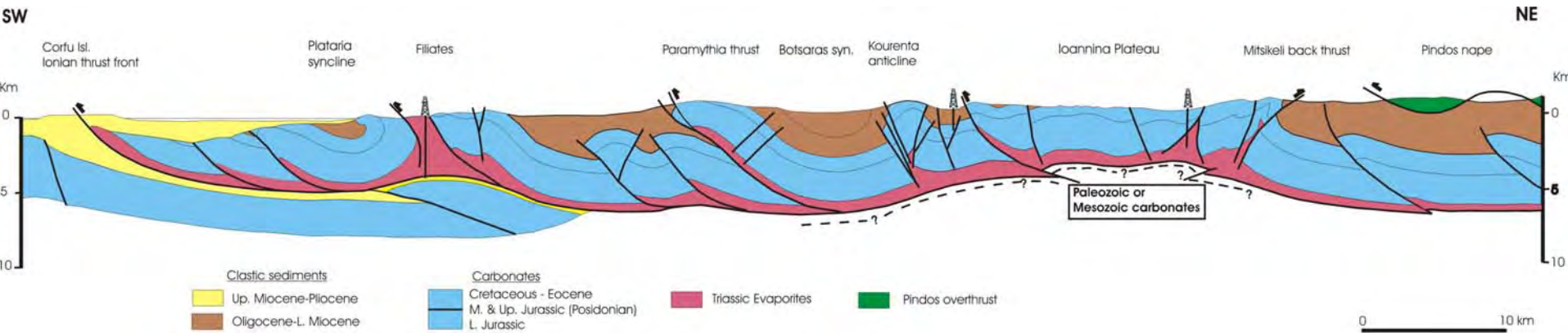


# **WESTERN GREECE : TECTONICS**

**THRUSTING AND OVERTHRUSTING SOUTH-  
WESTWARDS IS THE MAIN FEATURE OF  
TECTONIC EVOLUTION**

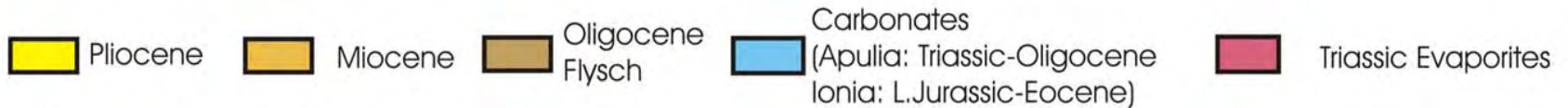
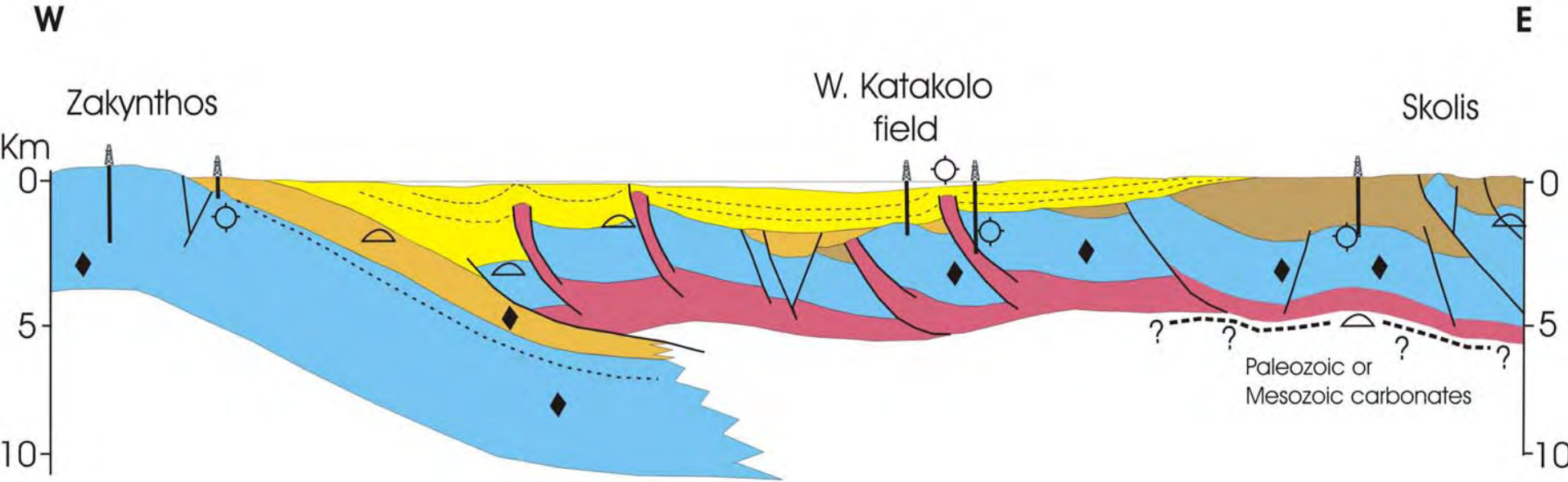
**THRUSTING AND OVERTHRUSTING AS A  
GENERAL PHENOMENON CREATES GREAT  
POSSIBILITIES AND POTENTIAL FOR OIL  
DISCOVERIES**

# Structural section across NW. Greece



# SW GREECE H/C PLAYS

## SYNTHETIC CROSS SECTION



- Source rocks
- Oil shows
- Prospects & leads

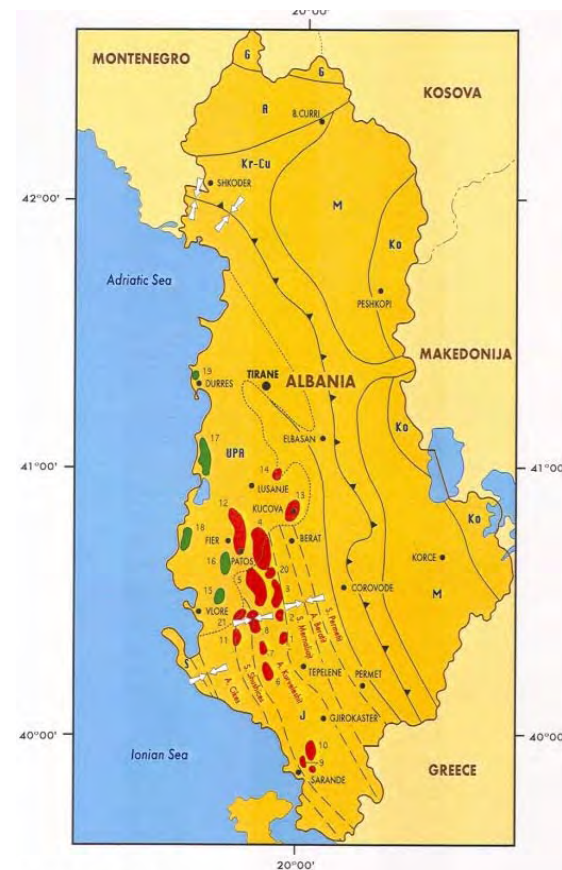


**Analogs in...**

**Albania**

# HYDROCARBON OCCURRENCES IN ALBANIA (OIL & GAS FIELDS)

OIL/GAS FIELD	DISCOV. YEAR	RESERVOIR TYPE
Drashovica	1918	Pg3-flysch
Patosi	1927	N13-Sandst
Kucova	1928	N13-Sandst
Marinza	1957	N13-Sands
Visoka	1963	Cr-Pg2-limst
Gor-Kocul	1965	J2-Pg2-lims
Ba-Hekal	1966	Cr-Pg2-limst
C-Mollaj	1977	Cr-Pg2-limst
Finiq-Krane	1973	Cr-Pg2-limst
Delvina	1987	Cr-Pg2-limst
Divjaka	1963	N13t-Sandst
B-Kryev	1983	N2pl-Sandst
Frakulla	1965	N13-sandst
Povelca	1987	N13-sandst
Panaja	1988	N13-sandst
Durrresi	1986	N13-sandst
Adriatik-4	1994	N13-sandst
Shpiragu	2001	Cr-Pg2-limst



## TECTONIC ZONES

UPR	PERI ADRIATIC DEPRESSION
S	SAZANI ZONE
J	JONIAN ZONE
K	KRAJA ZONE
Kr-Cu	KRASTA CUKALI ZONE
R	ALBANIAN ALPS
M	MIRDITA ZONE
Ko	KORABI ZONE
G	GASHI ZONE

## OIL & GAS FIELDS

1 - Karbunara (Cr<sub>2</sub>Pg<sub>1,2</sub>); 2 - Hekali (Cr<sub>2</sub>Pg<sub>1,2</sub>); 3 - Ballshi (Cr<sub>2</sub>Pg<sub>1,2</sub>); 4 - Patosi-Verbasi (Cr<sub>2</sub>Pg<sub>1,2</sub>); 5 - Mollaj-Cakran-Kreshpan (Cr<sub>1</sub>-Cr<sub>2</sub>Pg<sub>1,2</sub>N<sub>1</sub><sup>2</sup>); 6 - Amonice (Cr<sub>2</sub>Pg<sub>1,2</sub>); 7 - Gernec (Cr<sub>2</sub>Pg<sub>1,2</sub>); 8 - Gorisht-Kocul (J-Cr<sub>1</sub>-Cr<sub>2</sub>Pg<sub>1,2</sub>Pg<sub>3</sub><sup>1,2</sup>); 9 - Finiq-Krane (Cr<sub>2</sub>Pg<sub>1,2</sub>); 10 - Delvina (Cr<sub>2</sub>Pg<sub>1,2</sub>); 11 - Drashovica (Pg<sub>3</sub><sup>1,2</sup>); 12 - Patos-Marinze-Bubullime (N<sub>1</sub><sup>2</sup>Suites Bubullima, Marinze, Driza, Gorani); 13 - Kucove-Arrez (N<sub>1</sub><sup>2</sup>N13-Suites Driza, Gorani, Kucova, Polovina); 14 - Pekisht-Murriz-Rose (N<sub>1</sub><sup>2</sup>)

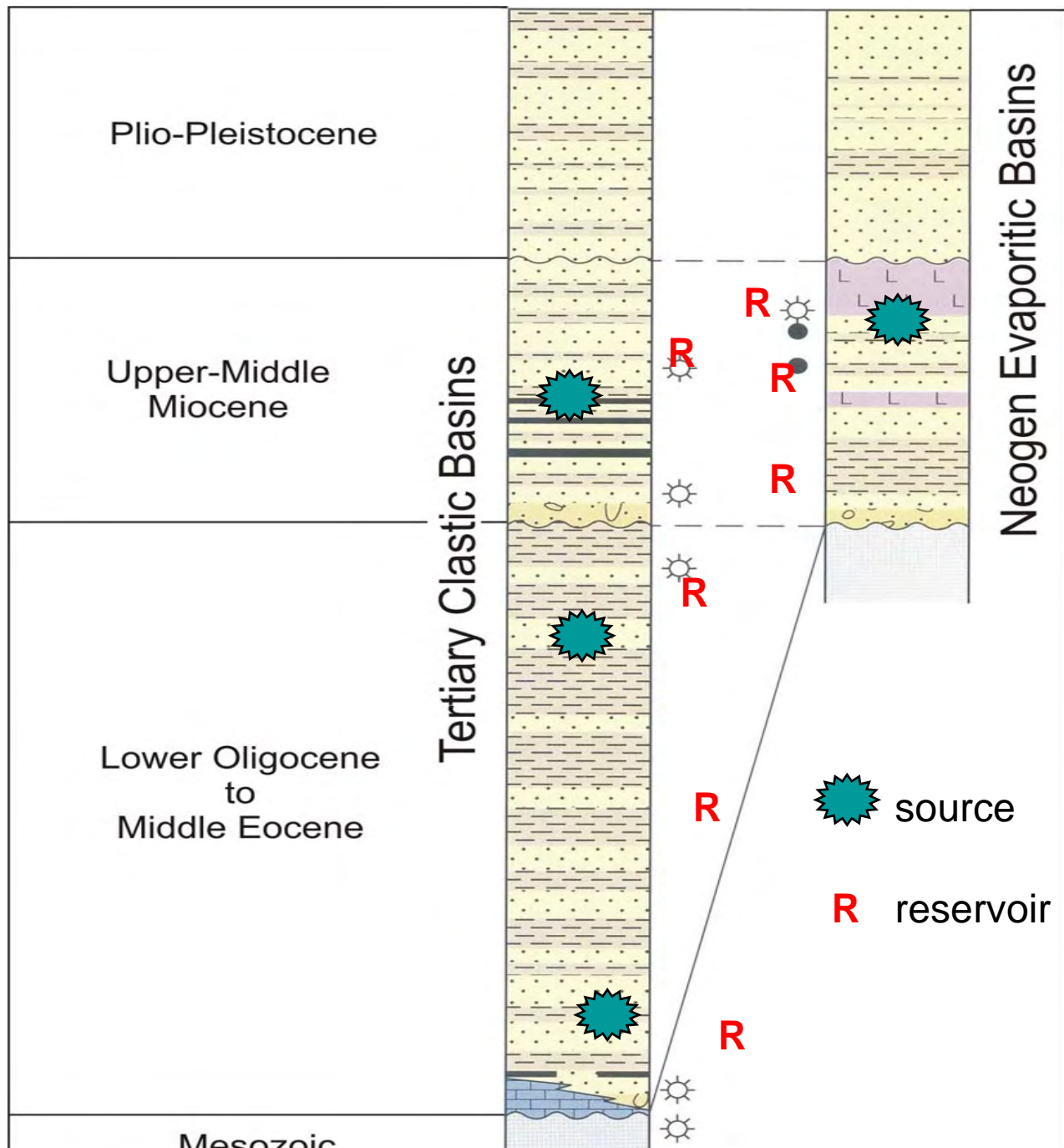
## GAS FIELDS

15 - Panaja (N<sub>1</sub><sup>2</sup>); 16 - Frakull (N<sub>1</sub><sup>2</sup>N<sub>1</sub><sup>3</sup>); 17 - Divjake-Ballaj-Kryevidh (N<sub>1</sub><sup>2</sup>N<sub>2</sub>-Suite Helmesi); 18 - Povelca (N<sub>1</sub><sup>2</sup>); 19 - Durrresi (N<sub>1</sub><sup>2</sup>)

## TARSAND FIELDS

20 - Kasnice-Patos; Treblove-Selenice

# Stratigraphy & source and reservoir Rocks Position of Eastern Tertiary Basins



# **GREEK H/C DISCOVERIES**

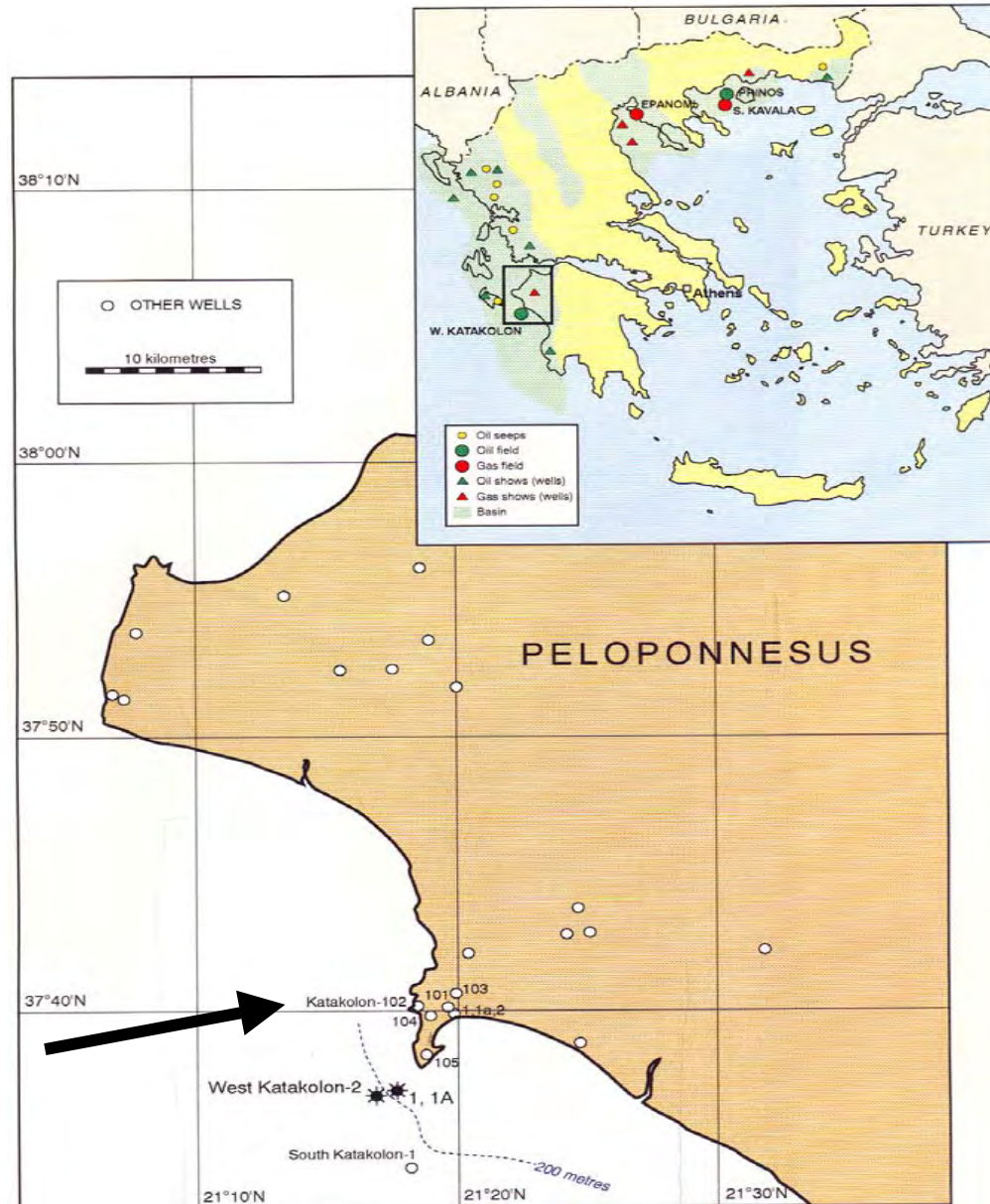
# Northern Aegean Producing fields

- **Prinos Oil Field**, cumulative production 115 MMbbls, 1981- 2007
- **Prinos North Oil Field**, ultimate production 2,9 mil.bbls, 1996- 2004
- **South Kavala Gas Field**, cumulative production 850 MM Nm<sup>3</sup> and 0,9 MM bbls of condensates, 1981- 2007

# Prinos Platforms



# OFFSHORE WEST KATAKOLON FIELD



# WEST KATAKOLO

## BASIC CHARACTERISTICS

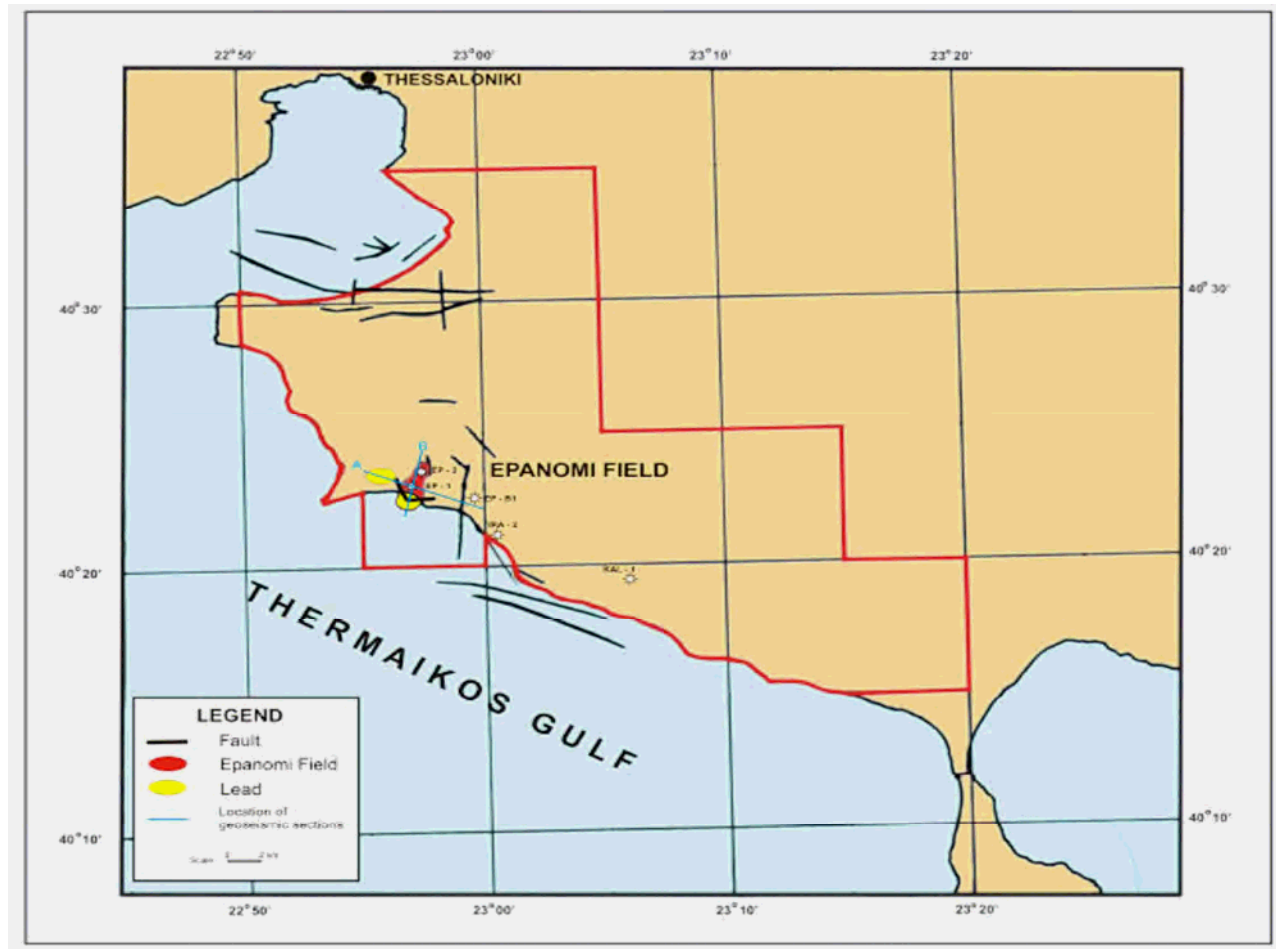
- Gas flow from two intervals, 11-12 million cubic feet/day from each one
- Oil flow in WKA-2 well, 1000-1500 barrels/day



# Oil DST, W. Katakolo - 2, 1982



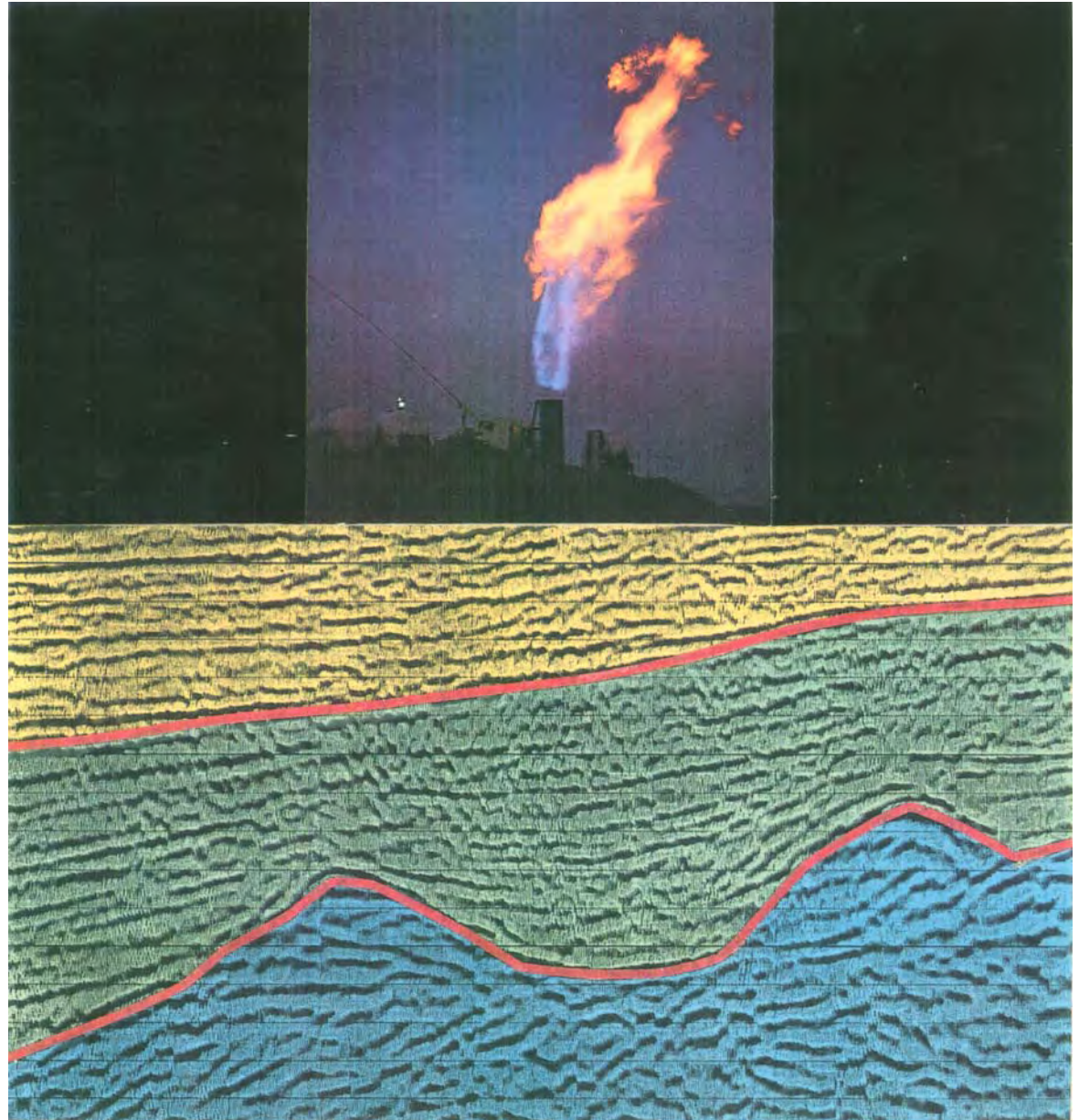
# Epanomi Gas discovery



# **Epanomi key facts**

- **It lies very close to the sea at a distance of 30 km from Thessalonici**
- **Two wells have been drilled**
- **Gas was tested from a gas bearing zone at a depth from 2600 to 2800 m**
- **Reservoir rock is a fractured mesozoic limestone**
- **The trap is a buried paleo-high**

EPANOMI  
STRUCTURE  
&  
PRODUCTION  
TEST



# ARE THE FUNDAMENTAL CONDITIONS OF HYDROCARBONS EXISTENCE IN GREECE IN EFFECT?

The Answer is YES

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

# Economic Evaluation – Assumptions

## Commercial Terms

### Type of Agreement

- Royalty-Taxes Lease Agreement

### Royalty Calculation

Royalty ranges from 2% of wellhead production up to 15% and is linked to the R Factor ratio on a sliding scale. Taxes = 40%

$$\text{R Factor} = \frac{\text{Cumulative Revenues}}{\text{Cumulative Costs}}$$

### Cost Recovery

Capital expenditures (both exploration and development) are depreciated by applying 80% on the value of the annual gross production

### Abandonment Cost

Estimated cost reserved on an annual basis and linked to the ratio of current production to total production

# CONCLUSIONS

## Reasons to Explore in Greece

- ➔ Good prospectivity for H/C exploration, with the relevant risk
- ➔ Close to infrastructures & pipelines
- ➔ Crossroad of H/C transportation
- ➔ It is expected that the Greek State will open the E-P market inviting oil industry to participate