

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

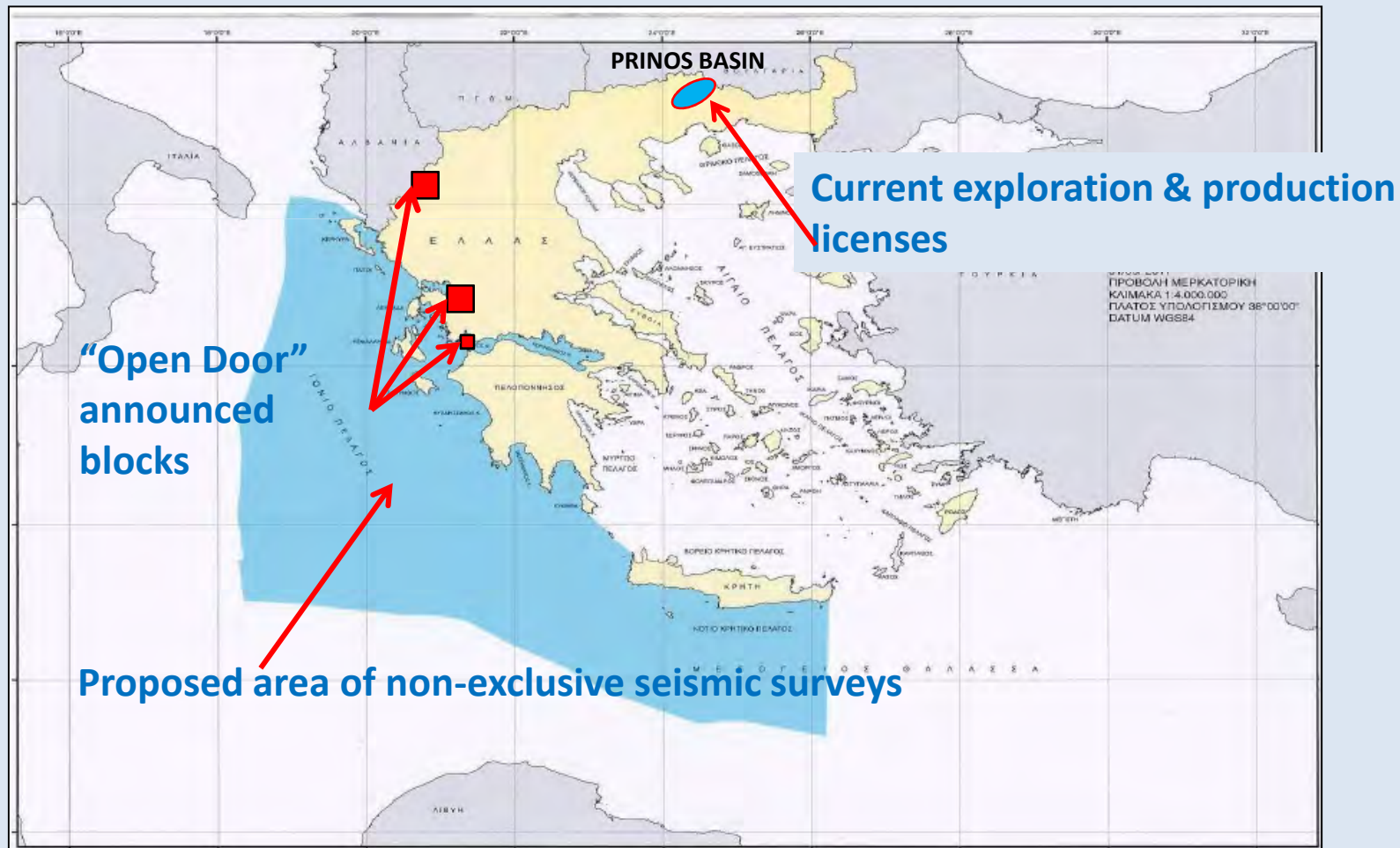
PLANNING FOR THE GREEK LICENSING ROUND

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Nicosia, Cyprus, January 26, 2012

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-nd day of March 2012
- Decision is expected within the 2-nd Quarter of 2012



Greece: First “Open Door” Exploration Areas

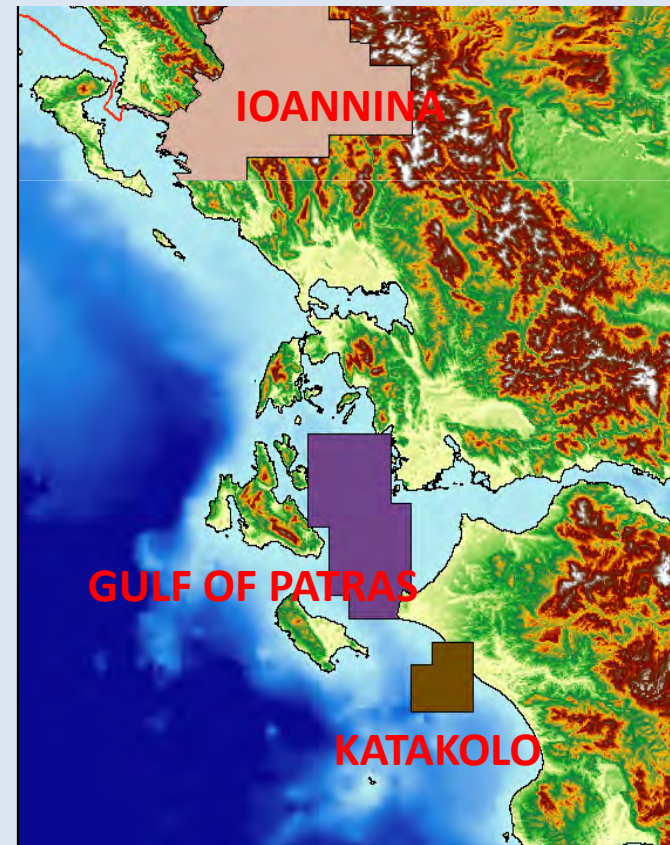
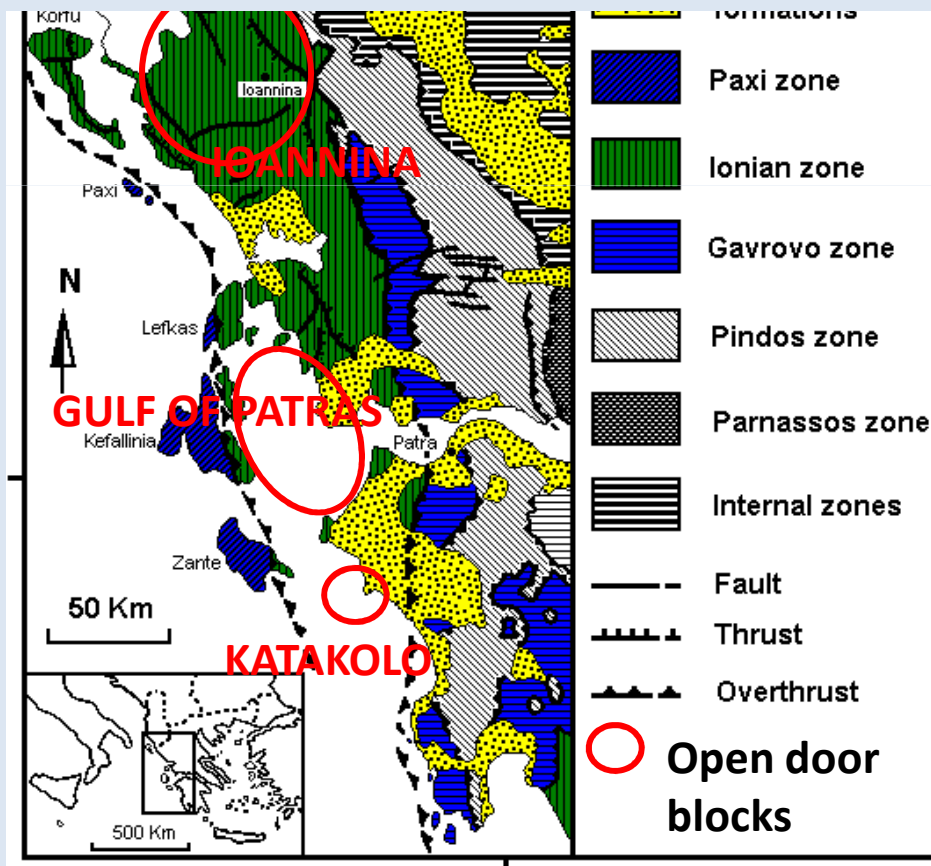
Areas integrated in the process “open door”

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



Offers are expected on July 2, 2012

External Hellenides geotectonic zones



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) %**

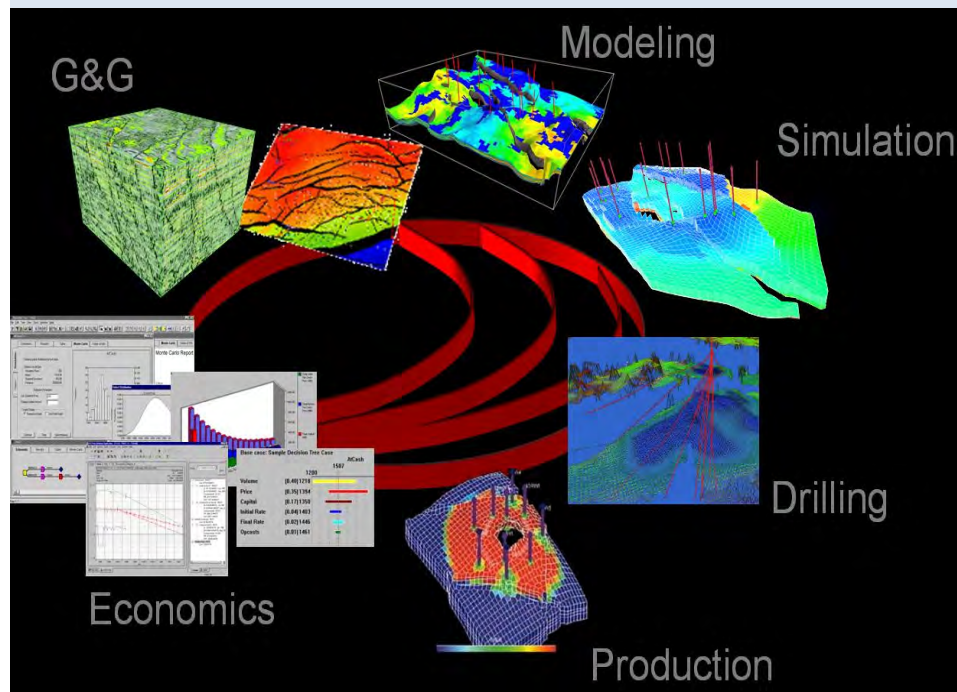


Analogues ???

EPEYNA και ΕΞΕΡΕΥΝΗΣΗ Υ/Α VS RESEARCH-EXPLORATION H/C

EPEYNA / 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

EPEYNA / 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



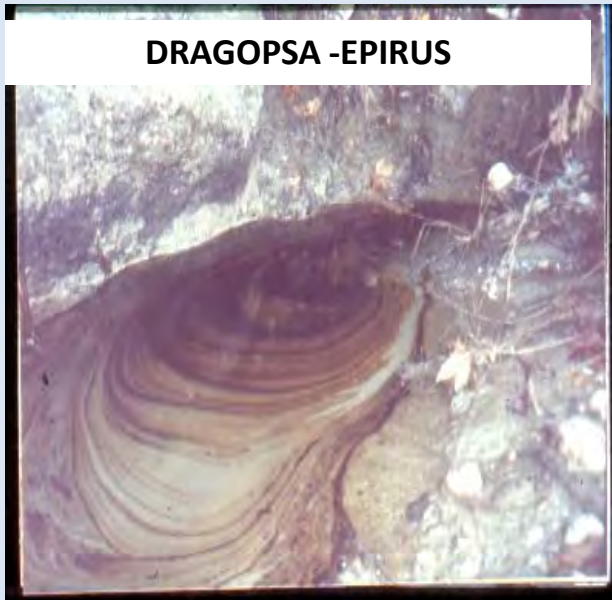
ZAKYNTHOS
HERODOTUS, 480 bc



KATAKOLON "Volcano" 1976



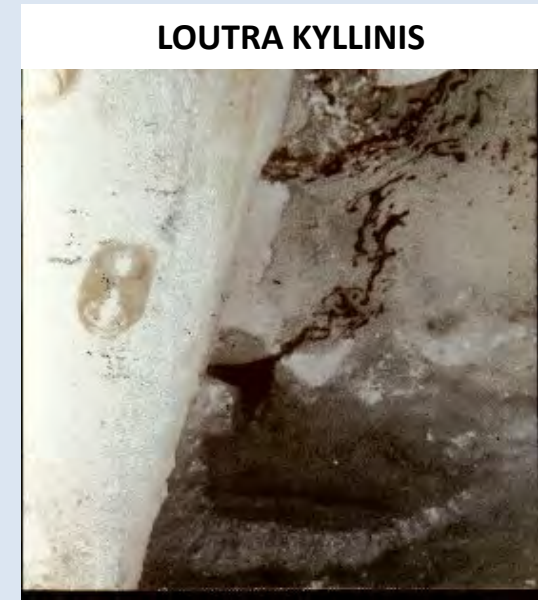
KATAKOLON "Volcano" 2004



DRAGOPSA -EPIRUS

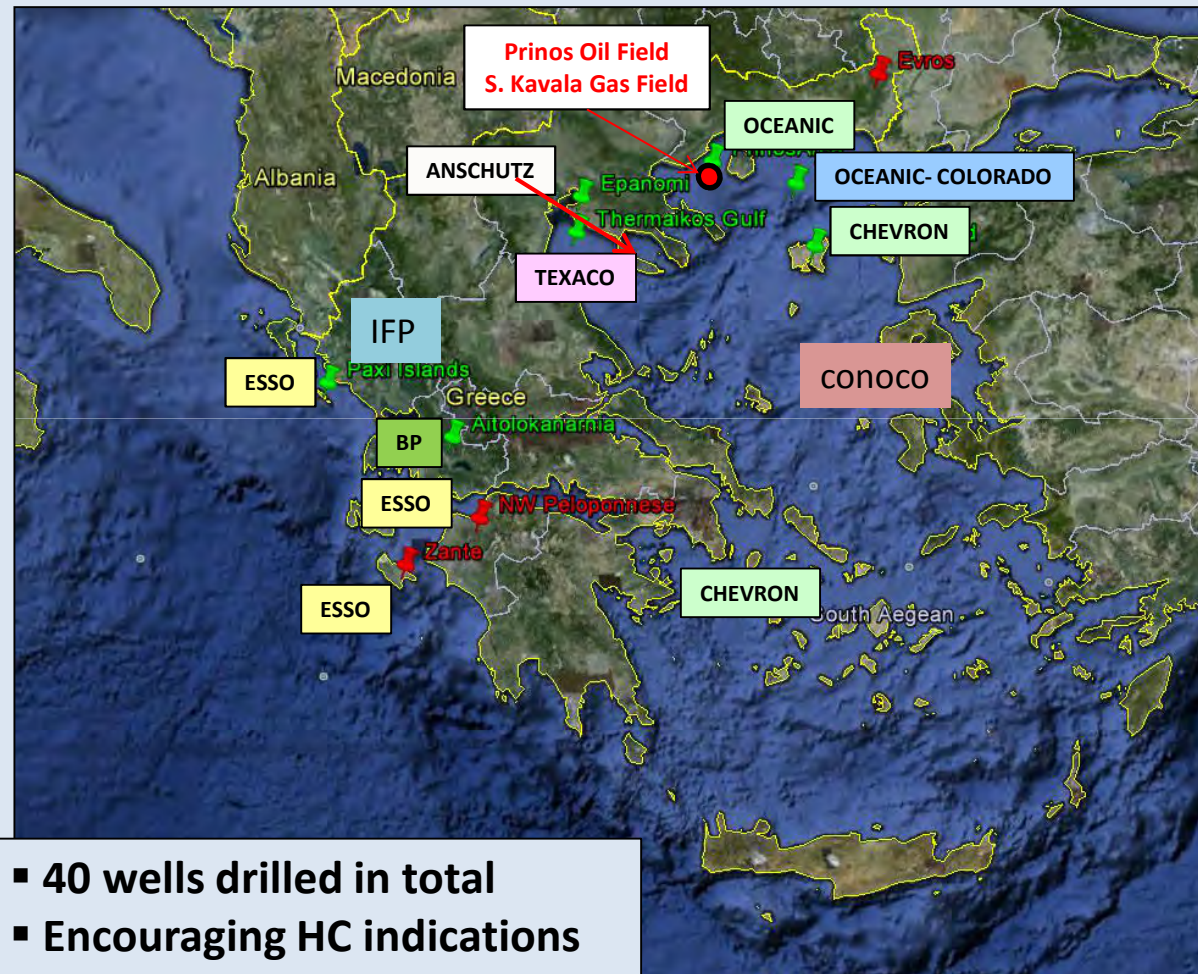


SMOLITSAS - EPIRUS



LOUTRA KYLLINIS

The History of Exploration Activity in Greece Early 60's to mid 70's



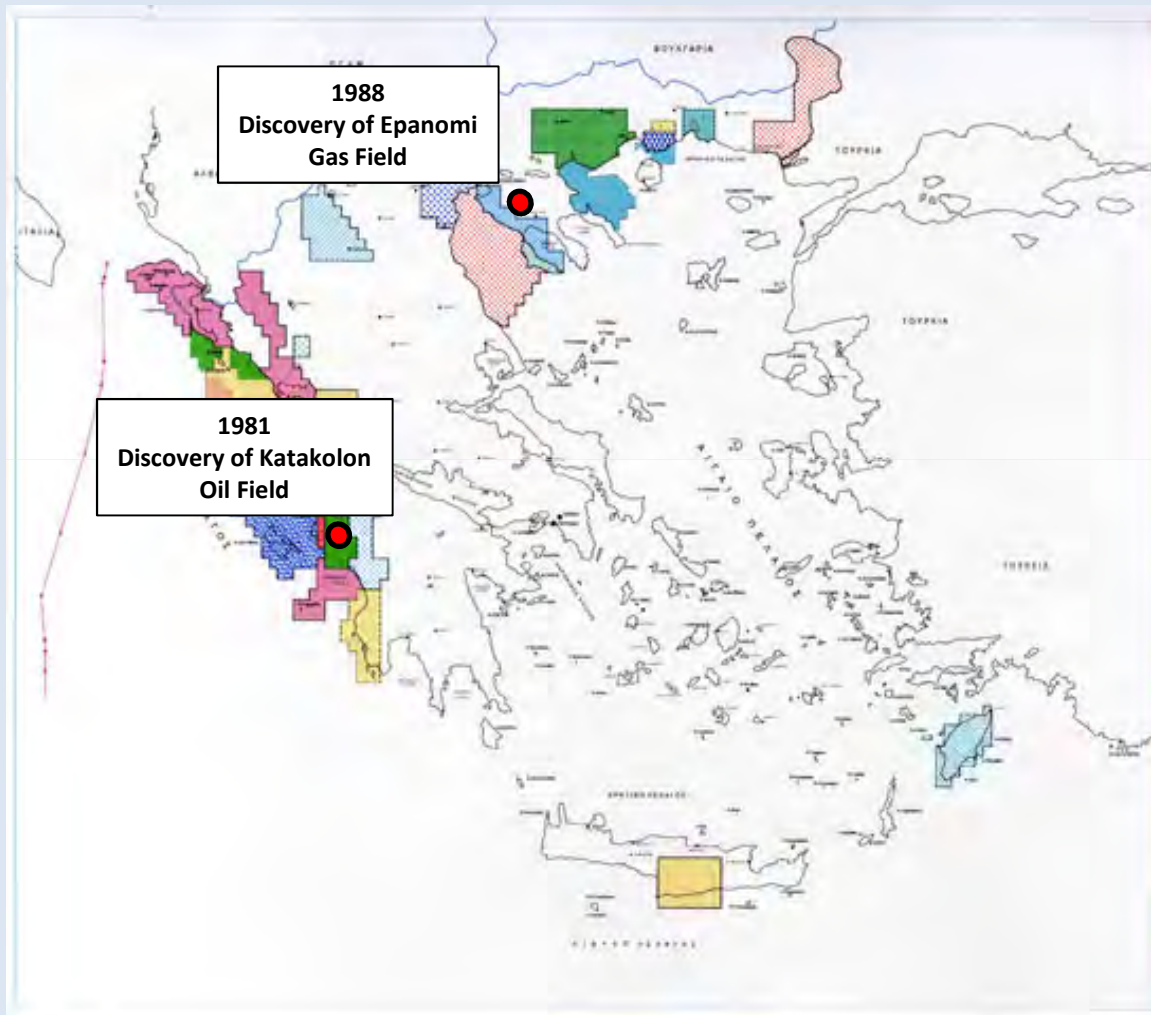
- 40 wells drilled in total
- Encouraging HC indications
- Improvement of geological background

OPERATORS

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

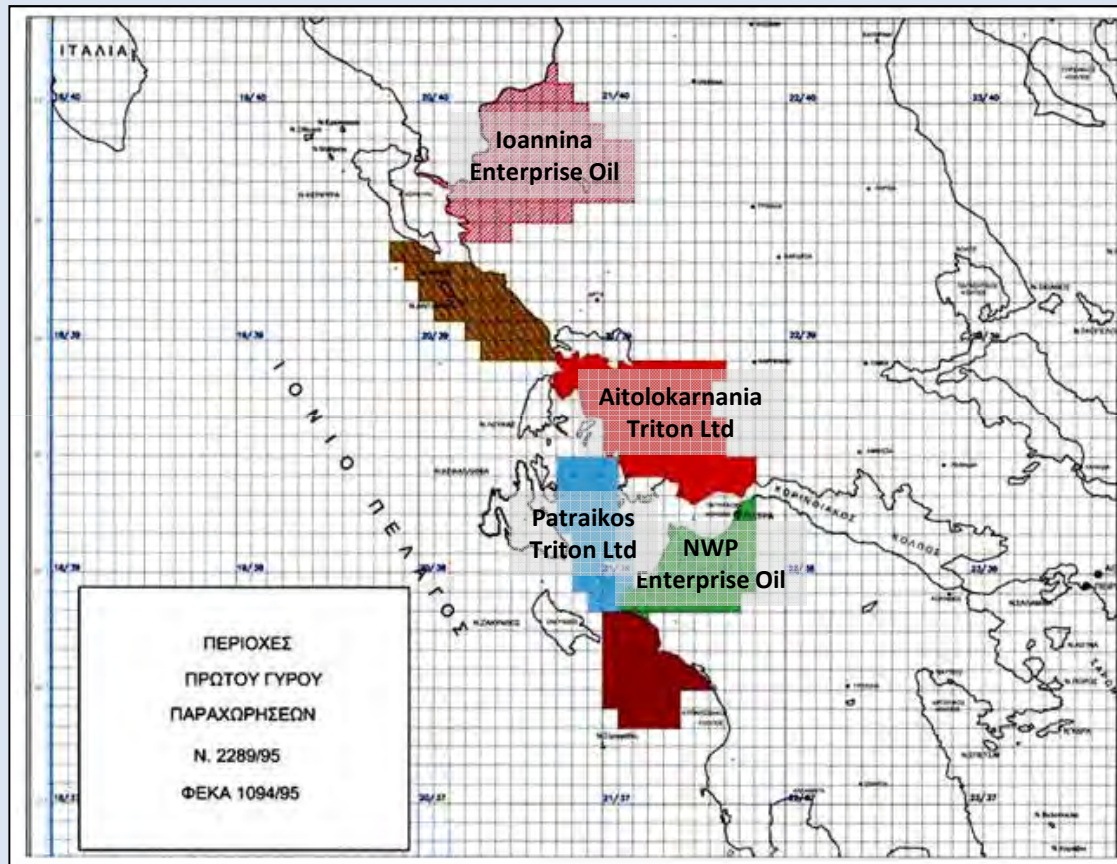
The final result of the exploration that took place during that time was the discovery of the first exploitable hydrocarbon reserves in the off-shore area of Thasos island (Prinos oil-field and South Kavala gas-field) by OCEANIC (1971-1974).

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€.

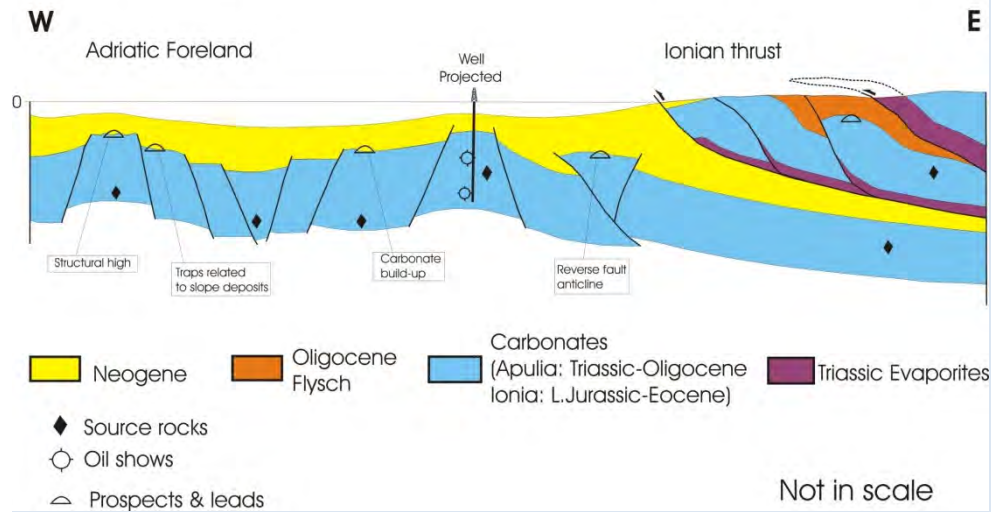
- All wells were P&A with minor HC shows.

- Acquisition of Triton Ltd by Amerada Hess and acquisition of Enterprise Oil by Shell and the companies withdrew in 2000-2001. (low oil prices)

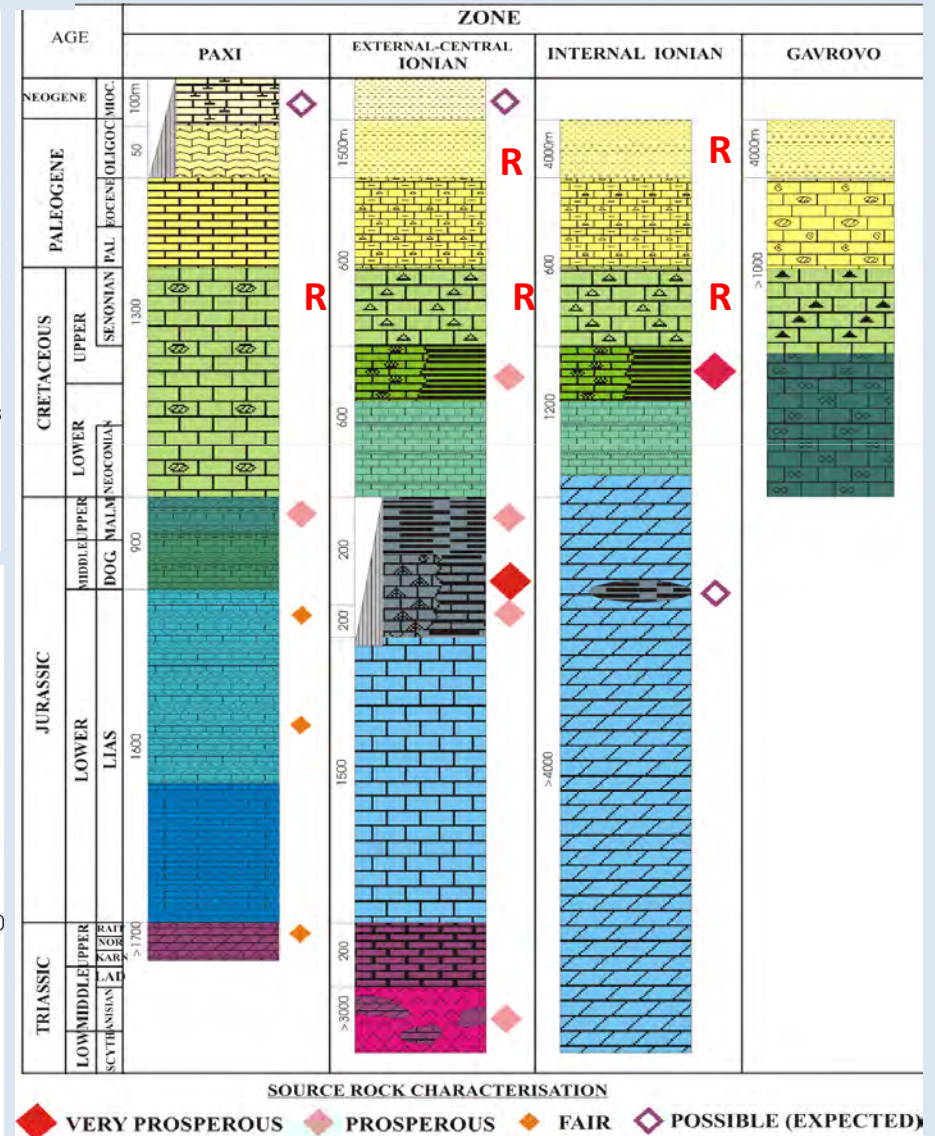
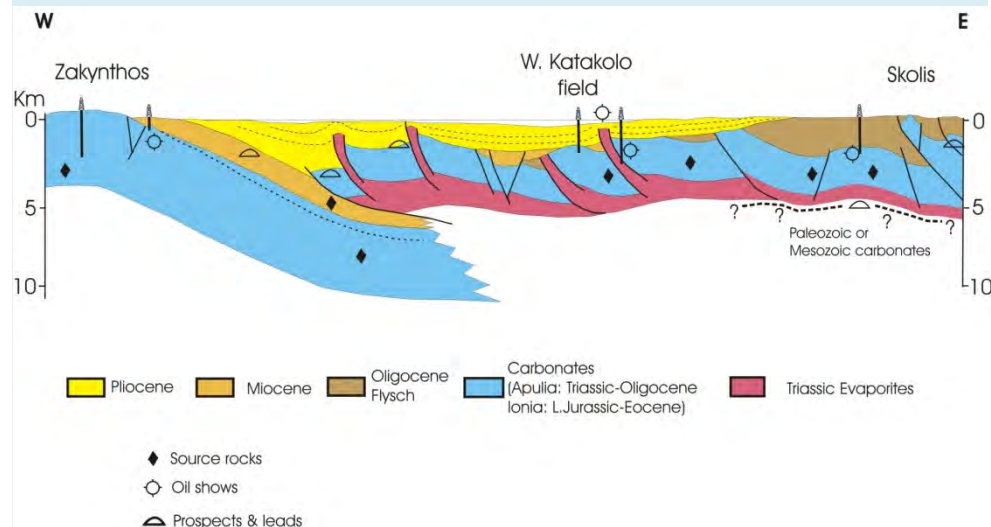
Greece: Geological Summary of the External Geotectonic Zones of W. Greece

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

GROUP	GEOTECTONIC ZONE	AREA	SOURCE ROCK	AGE	OILWINDOW
A (A1-A2)	CENTRAL IONIAN	EPIRUS (BOTSARA)	POSIDONIA BEDS	MIDDLE JURASSIC	3750-5800 m
B	CENTRAL IONIAN	TRIFOS KYLLINI W. KATAKOLO	VIGLA SHALES	LOWER CRETACEOUS	3450-5600 m (Internal Ionian)
C	CENTRAL IONIAN	DELVINAKI S. KATAKOLO ETOLIKO-1	TRIASSIC BRECCIAS	TRIASSIC	1000-3600 m
D1	PAXI	ZANTE	CLASTIC SEDIMENTS	MIOCENE	5800-7850 m
D2	GAVROVO	FILIATRA	EVAPORITES		
E	PAXI	PAXI ISLAND	APTICI SHALES	M-U JURASSIC	5600-7250 m

Source Rocks and oil seeps in Western Greece

Lower Posidonia beds



Lower Posidonia beds



Loutra Kyllinis oil seep



Zakynthos: Miocene source rocks

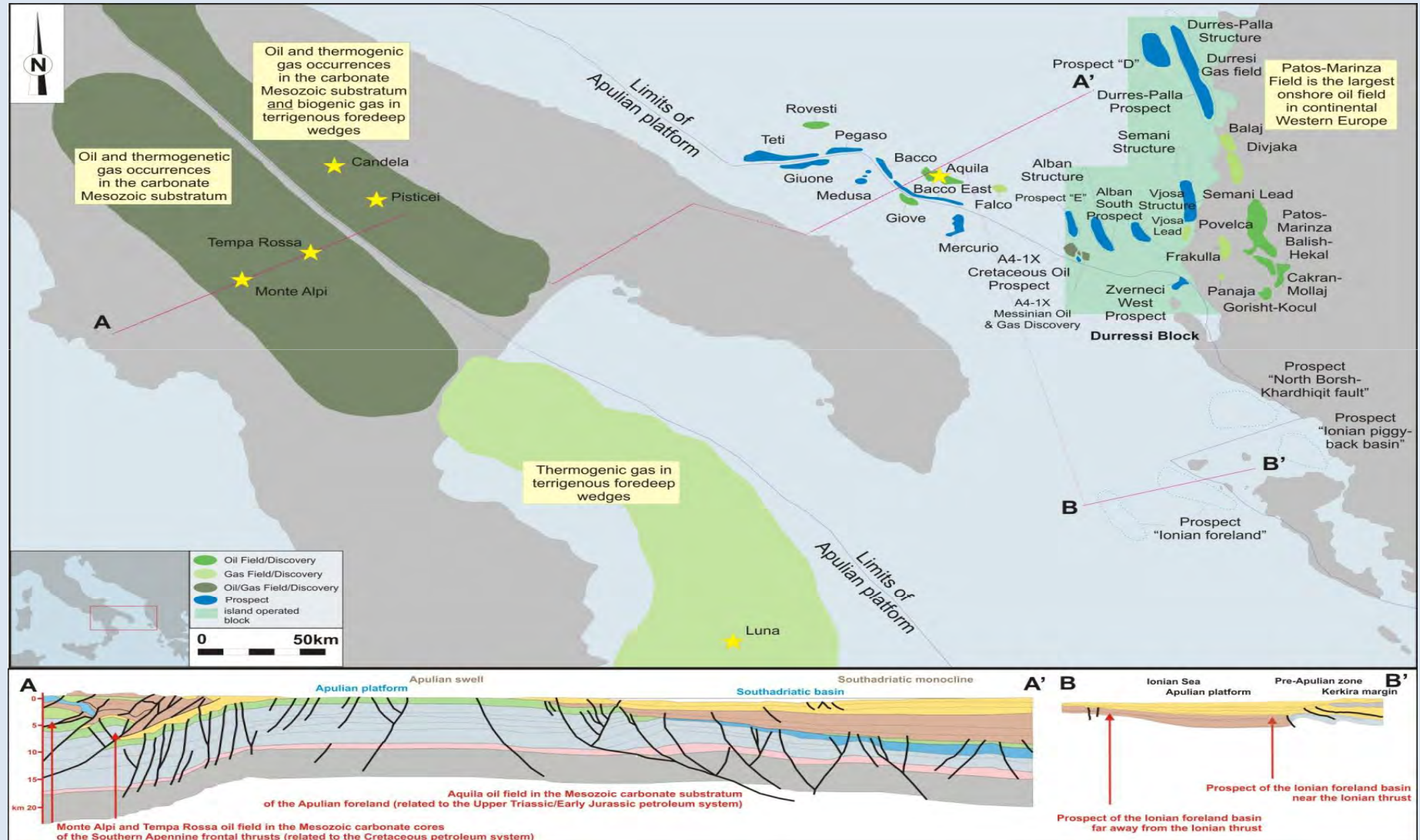


HERODOTUS OIL SEEP

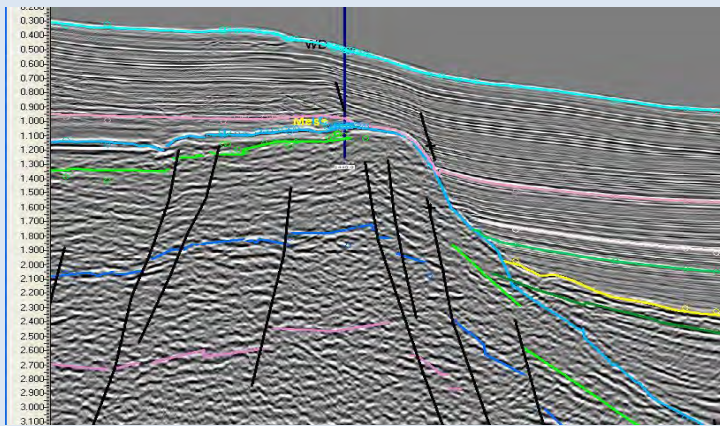
Dragopsa Oil Seep



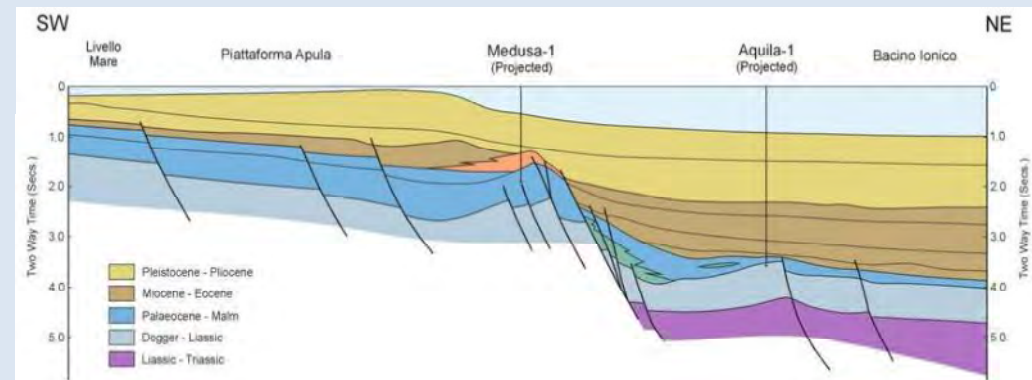
Synthetic sketch map showing Italian and Albanian hydrocarbon plays with an attempt for correlation with the northwestern part of Greece.



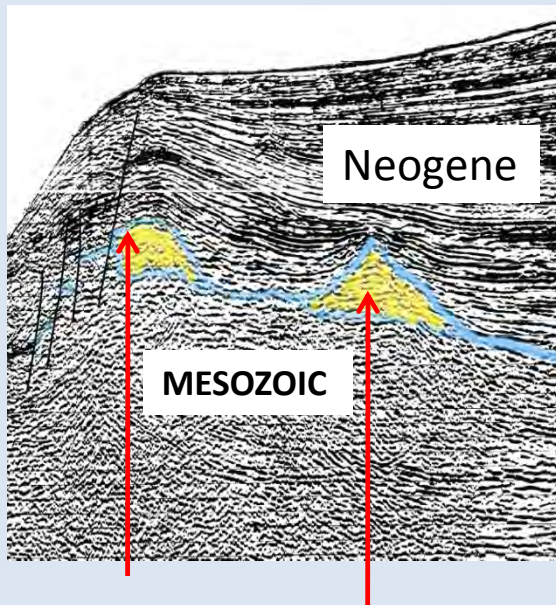
Analogue : South Adriatic in Italy and North Ionian in Greece



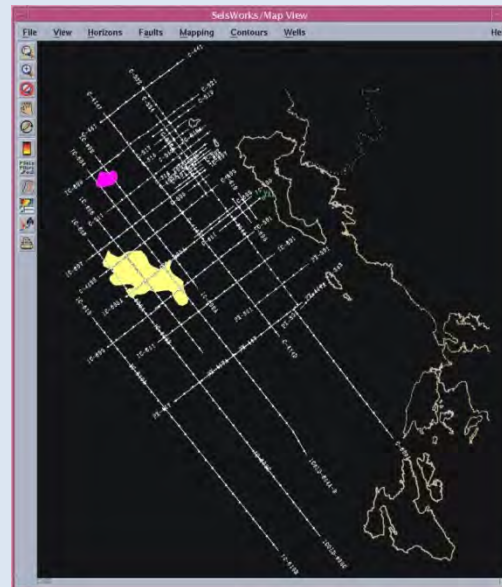
Carbonate platform margin “build-ups” in the Adriatic Sea in ITALY



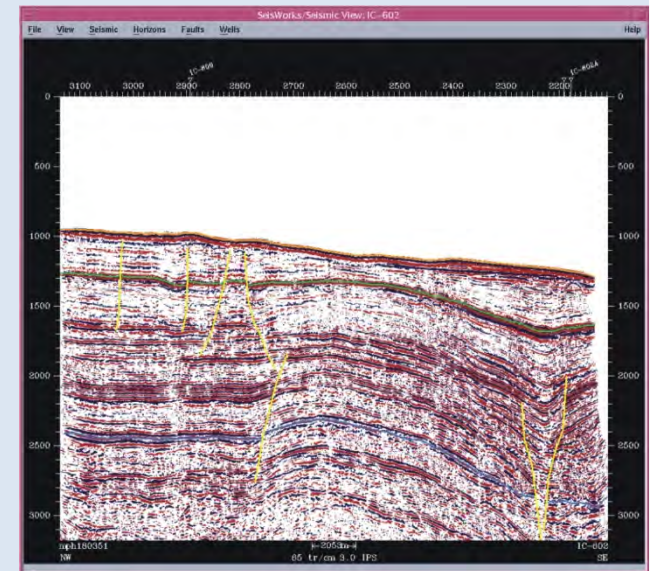
1. Platform margin build-ups (Giove, Medusa discoveries)
2. Pelagic Carbonates -Paleo-structures (Rovesti discovery / Aquila field)
3. Proximal Talus Slope Play
4. Platform Rotated Fault Blocks (Cretaceous/Jurassic)
5. Distal Calcarene Turbidites (re-sedimented platform carbonates – Aquila field)



West Lefkas - Reefal build-ups
In Greece

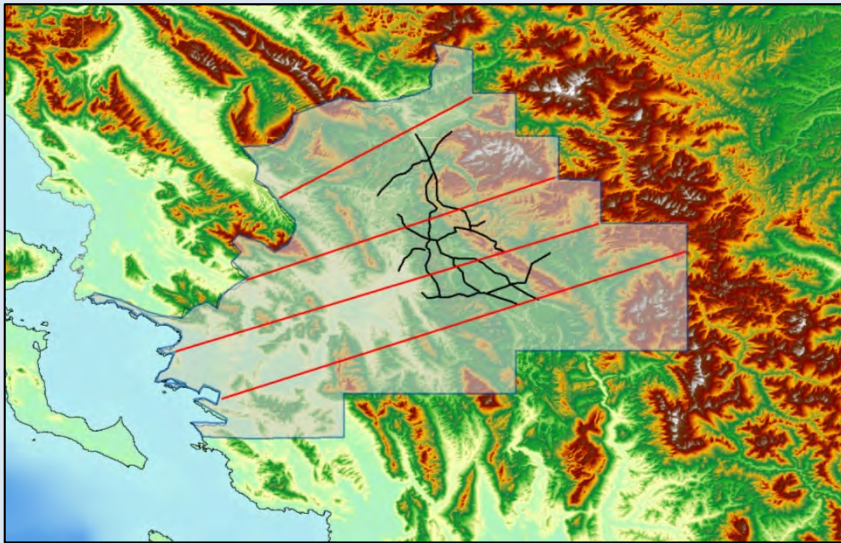


West CORFU:
400 sq. Km structure



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

IOANNINA BLOCK



Available Data

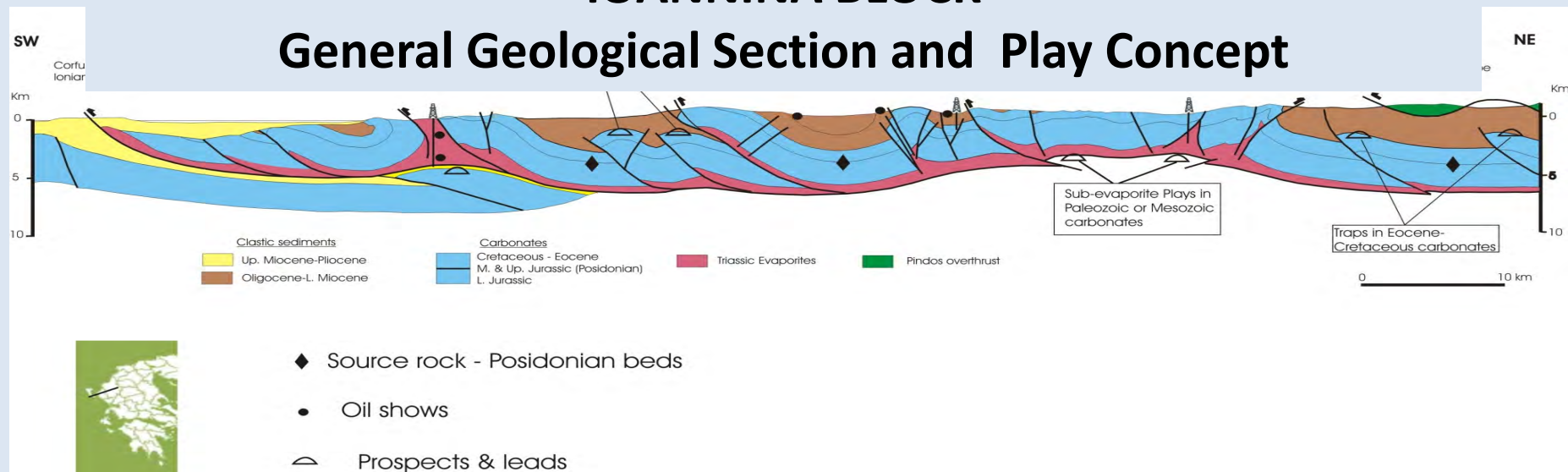
2 D Seismic 1015 km, (408 km by Enterprise Oil).

Wells: 11 (Enterprise Oil 1 and 1 side track)

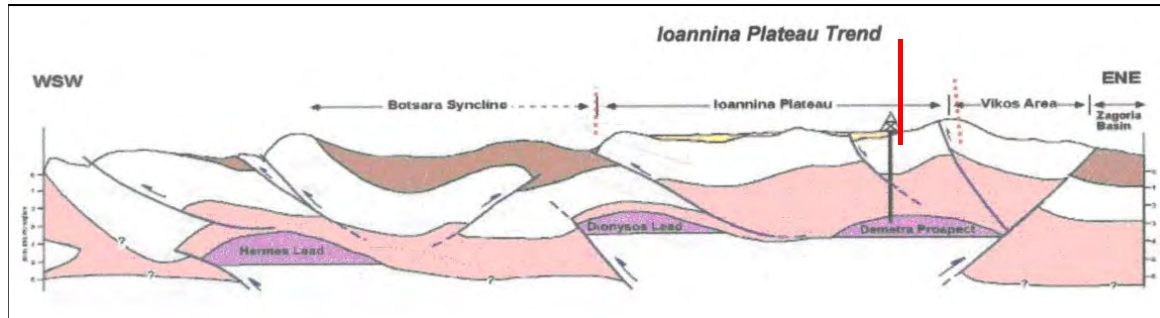
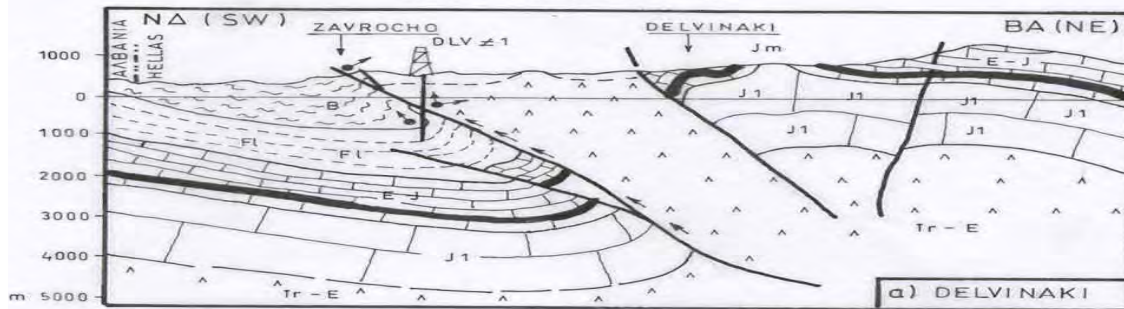
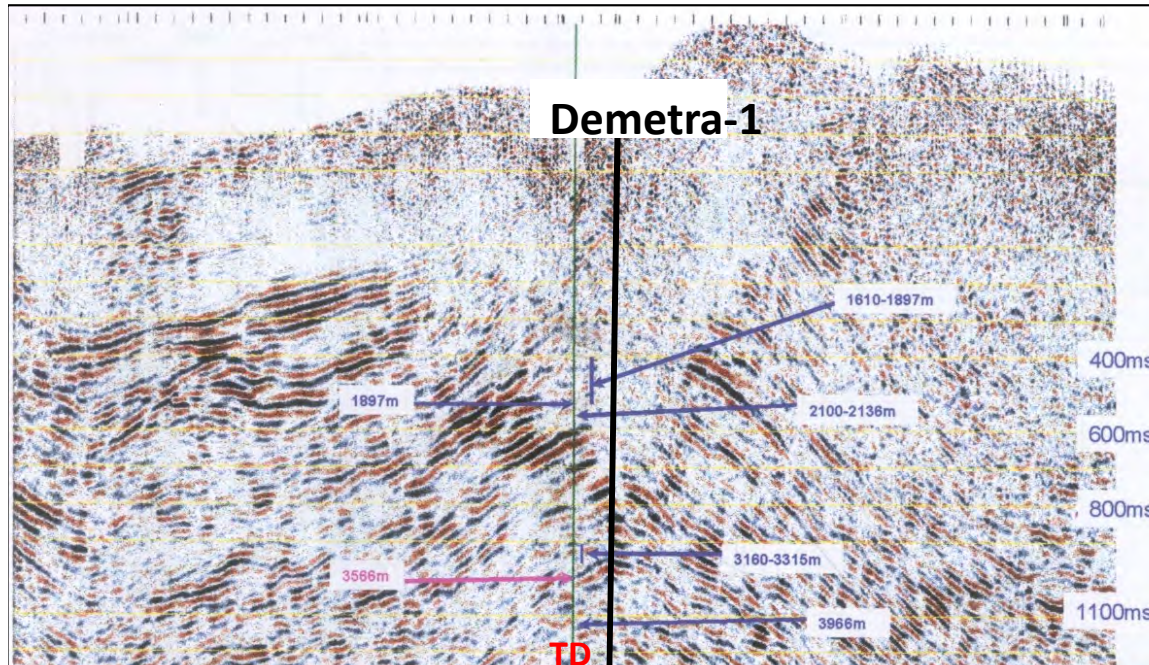
(Demetra # 1, 3966 μ and 1 site track till 3600 μ)

IOANNINA BLOCK

General Geological Section and Play Concept



Ioannina Block: Demetra-1 & -1z



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

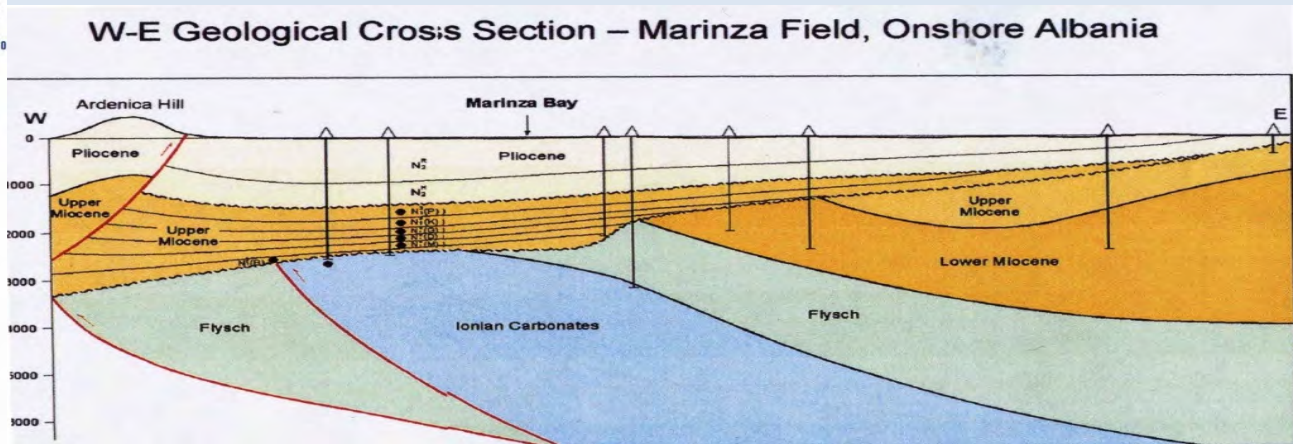
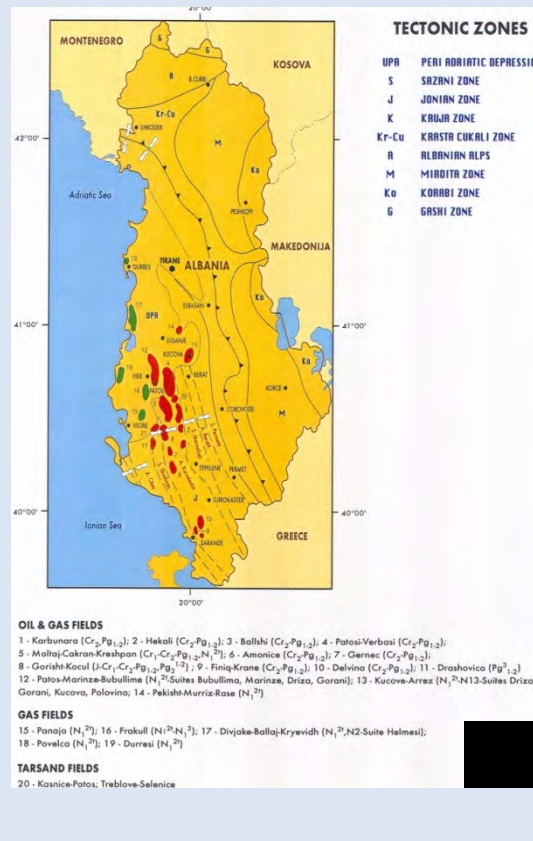
Summary of Demetra -1z

- well was sidetracked from 2807m
- @ 3566m high pressures occurred (17.5ppg)
- Increase of mud weight at 17,9 ppg
- Drilling stopped @ TD of 3600m after 162 days

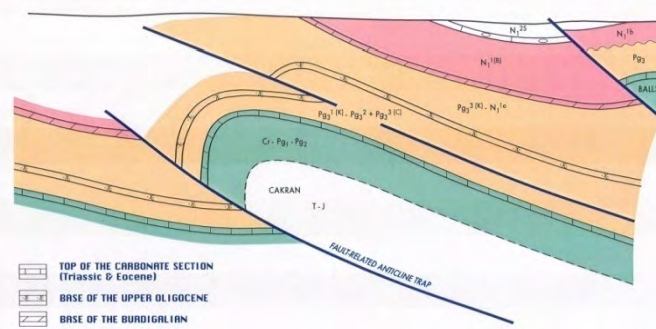
DLV-1

- Analogue well with high pressures in the region

ANALOGUES and HYDROCARBON OCCURRENCES IN ALBANIA (OIL & GAS FIELDS)

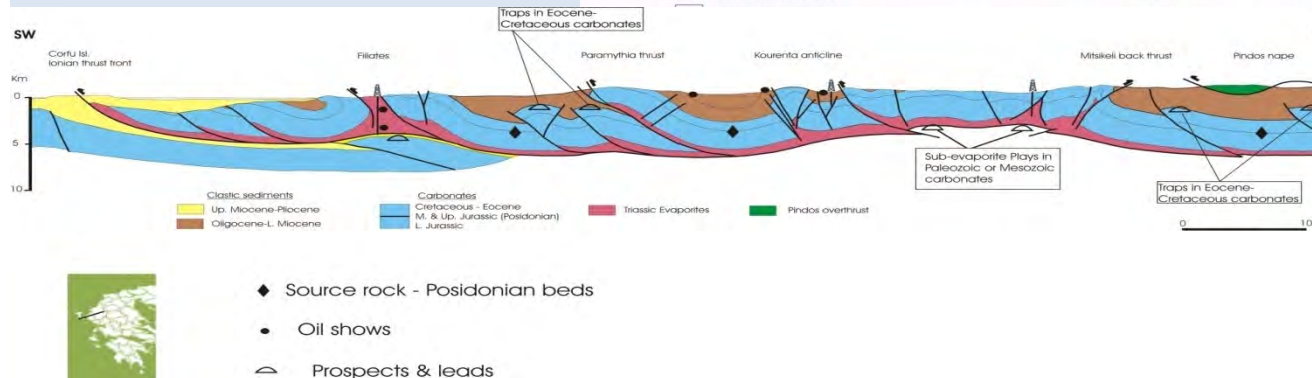
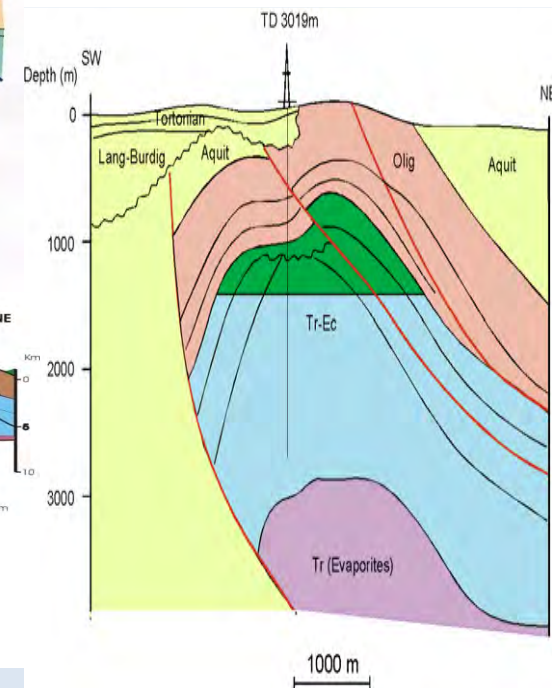


Schematic Geological Cross-Section of Cakran Oil Field



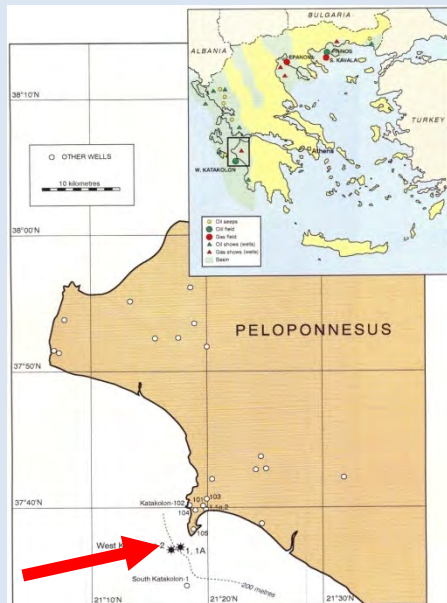
Gorishti

GORISHTI Field



Structural section across NW. Greece

OFFSHORE WEST KATAKOLON FIELD AS A KEY CASE



Depth map of the top of Carbonates, showing the WOC and OGC levels, based on 2-D seismic



▪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

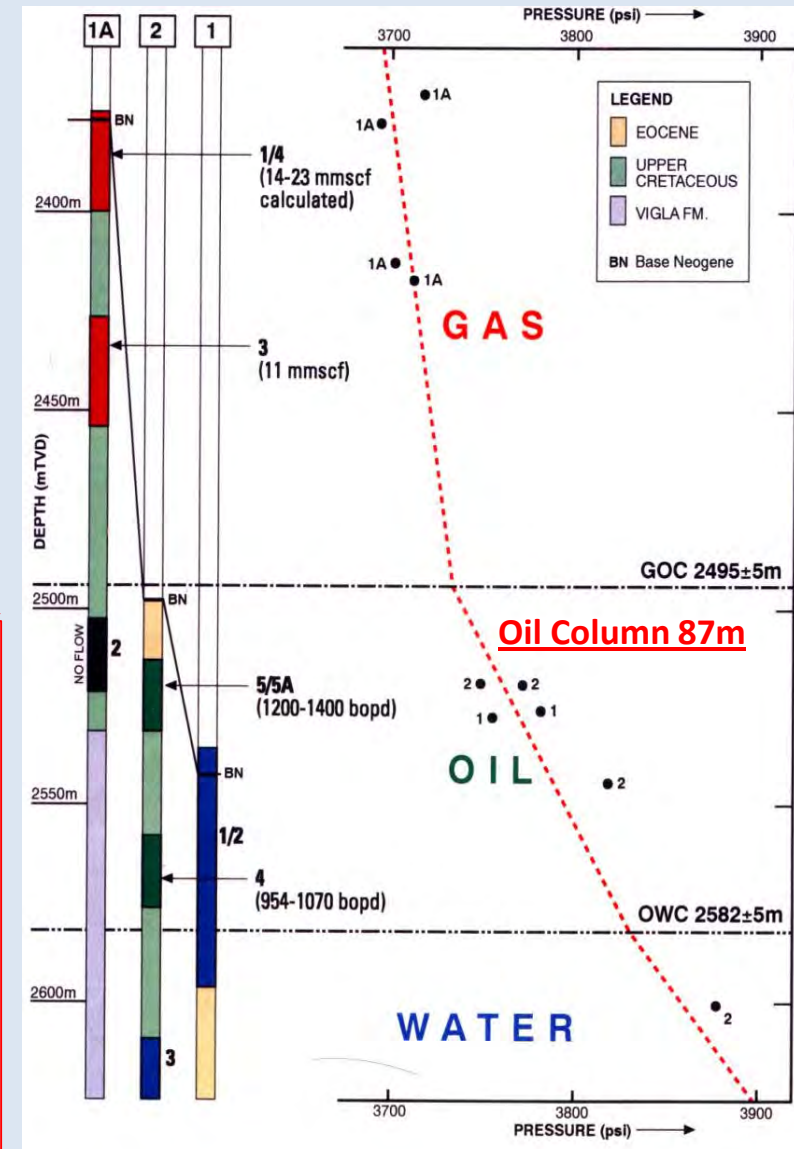
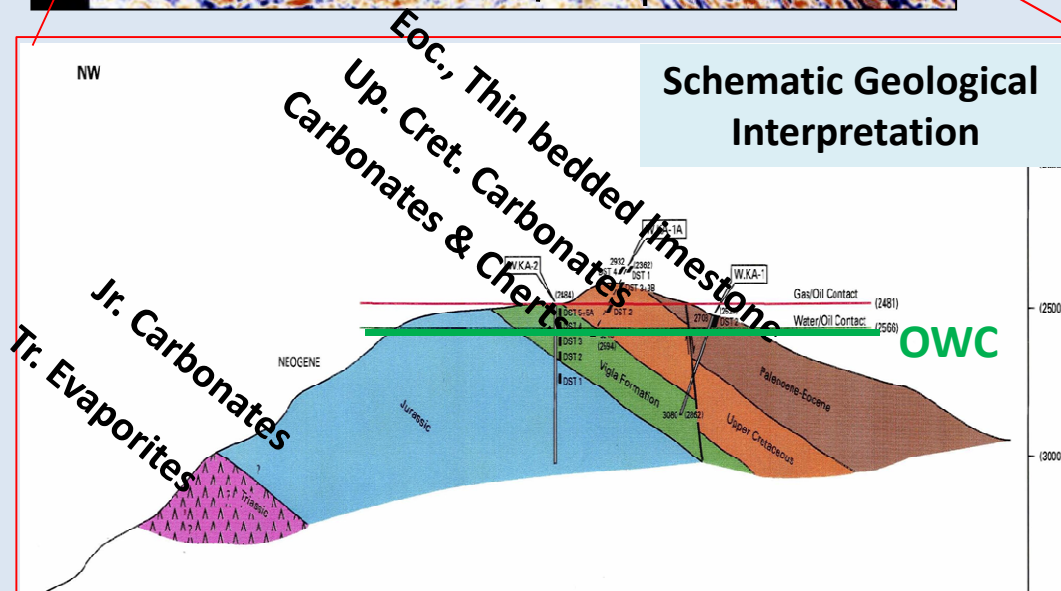
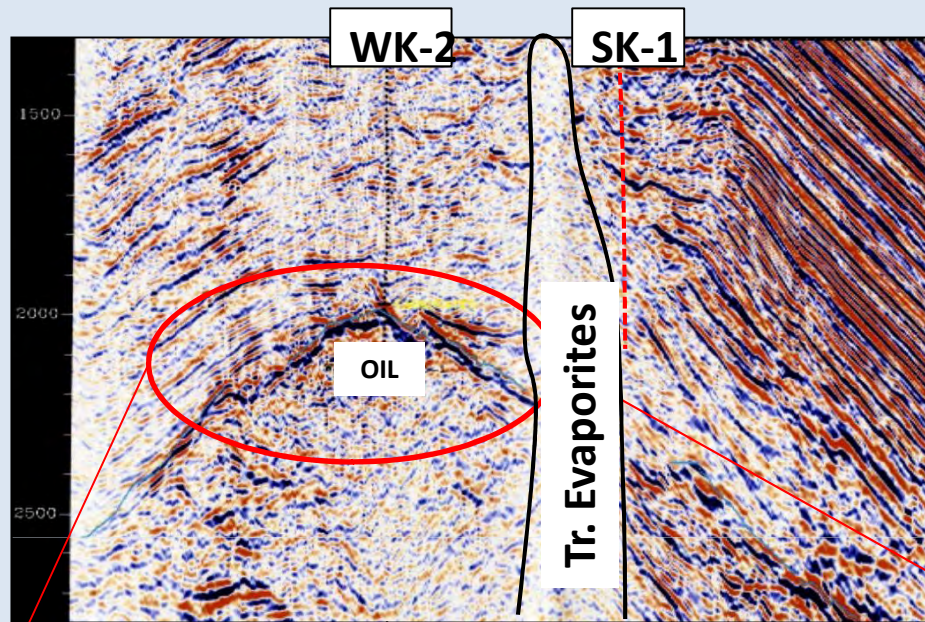
▪In WK-1a Gas flowed from two layers in the Gas Cap with flow rates up to 11MMSCFD from each zone.

▪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



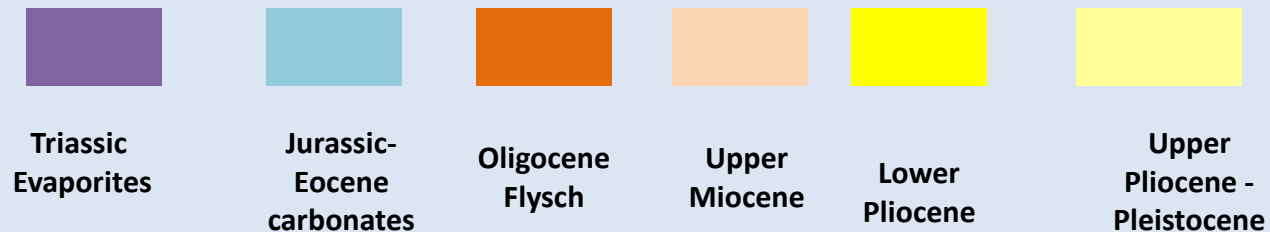
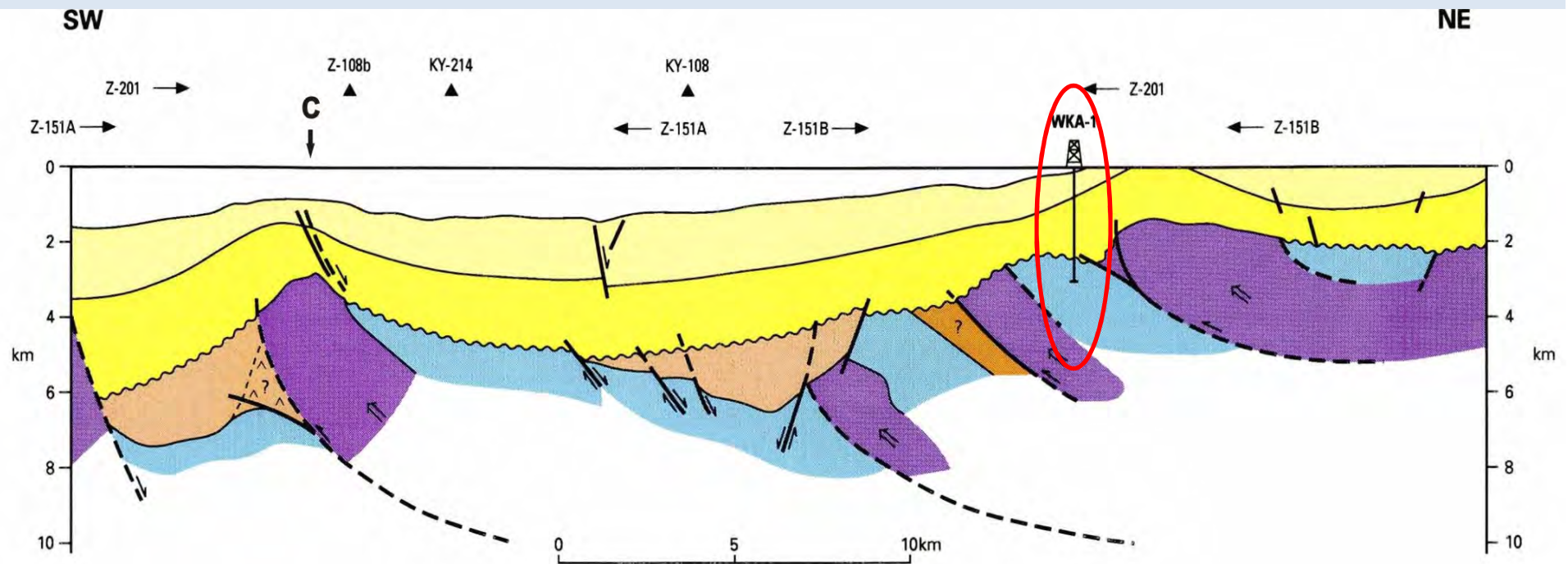
**W. Katakolo - 2,
1982 , DST,**

Greece : Exploration Potentiality of Katakolo Oil Field

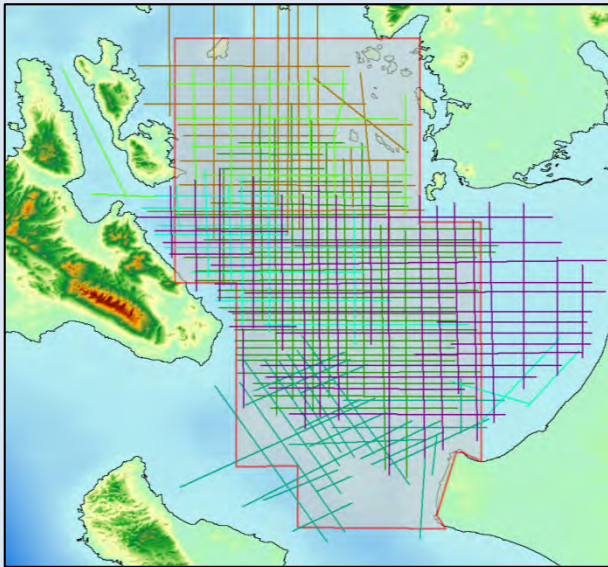


W. Katakolo As a key case

[field geoseismic section (based on 2D profiles)]

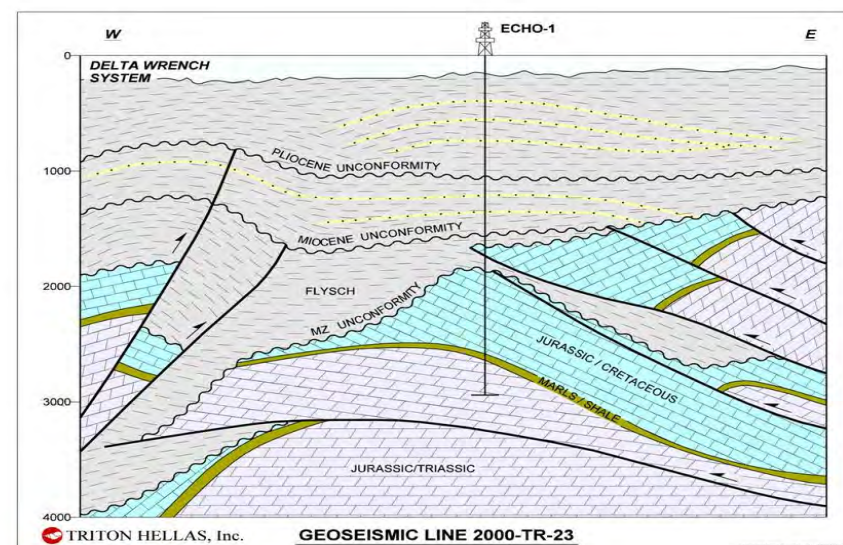
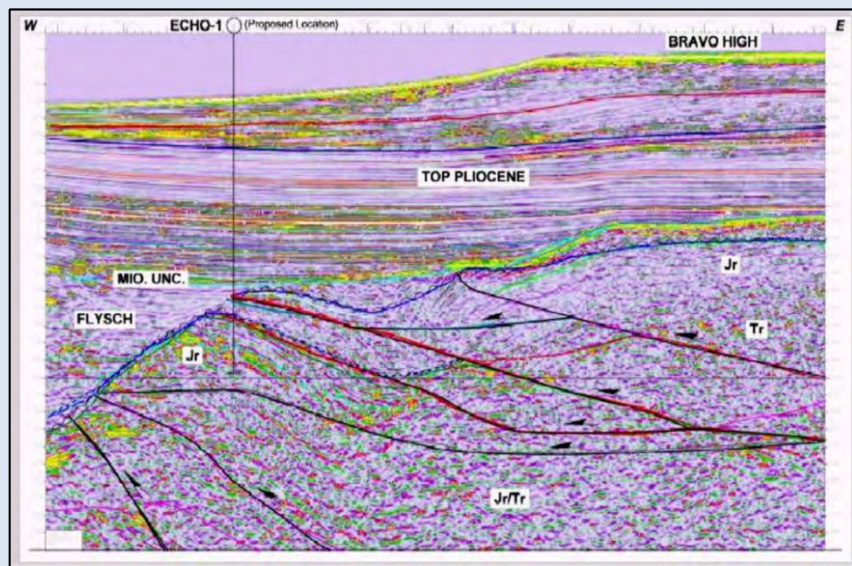


Gulf of Patras



Block History

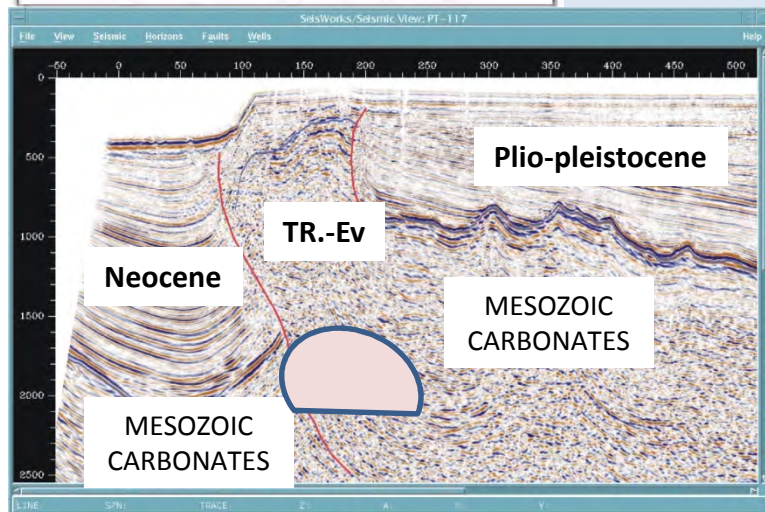
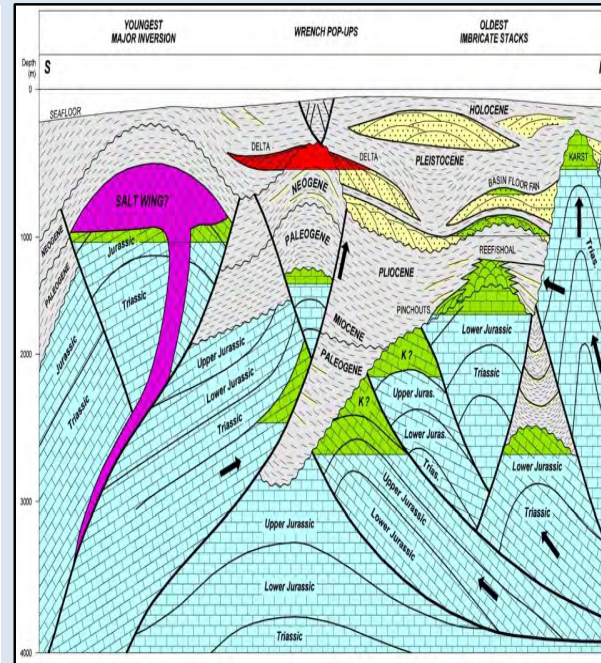
- 2D seismic data were acquired before 1982
- Modern seismic data acquired in 2000 by Triton Hellas
- Both surveys have been reprocessed
- 3 shallow (around 1200m) wells drilled within the concession area



Map of potential leads (*Triton Hellas 2000*)

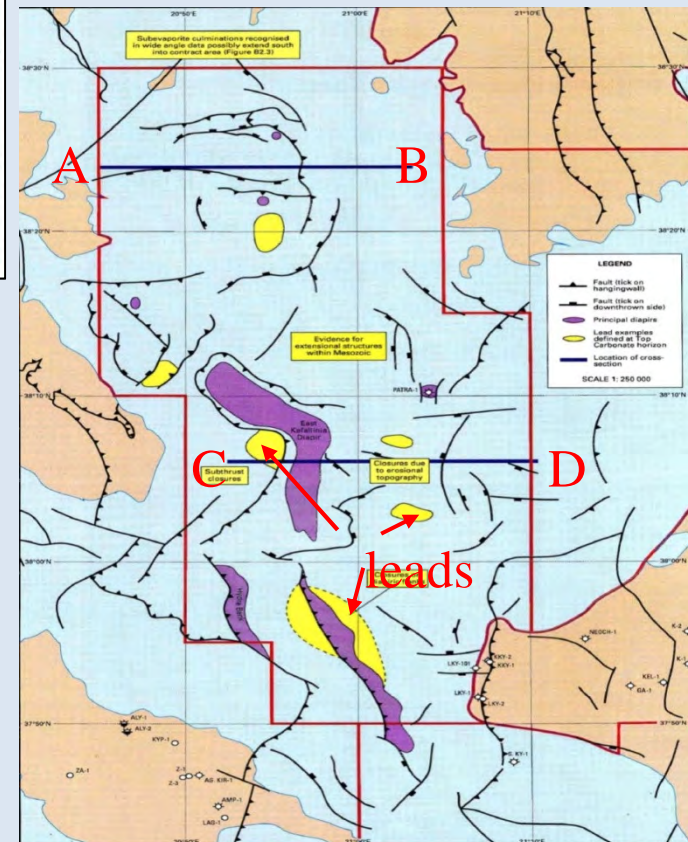
- Overall the area can be considered very interesting.

- 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

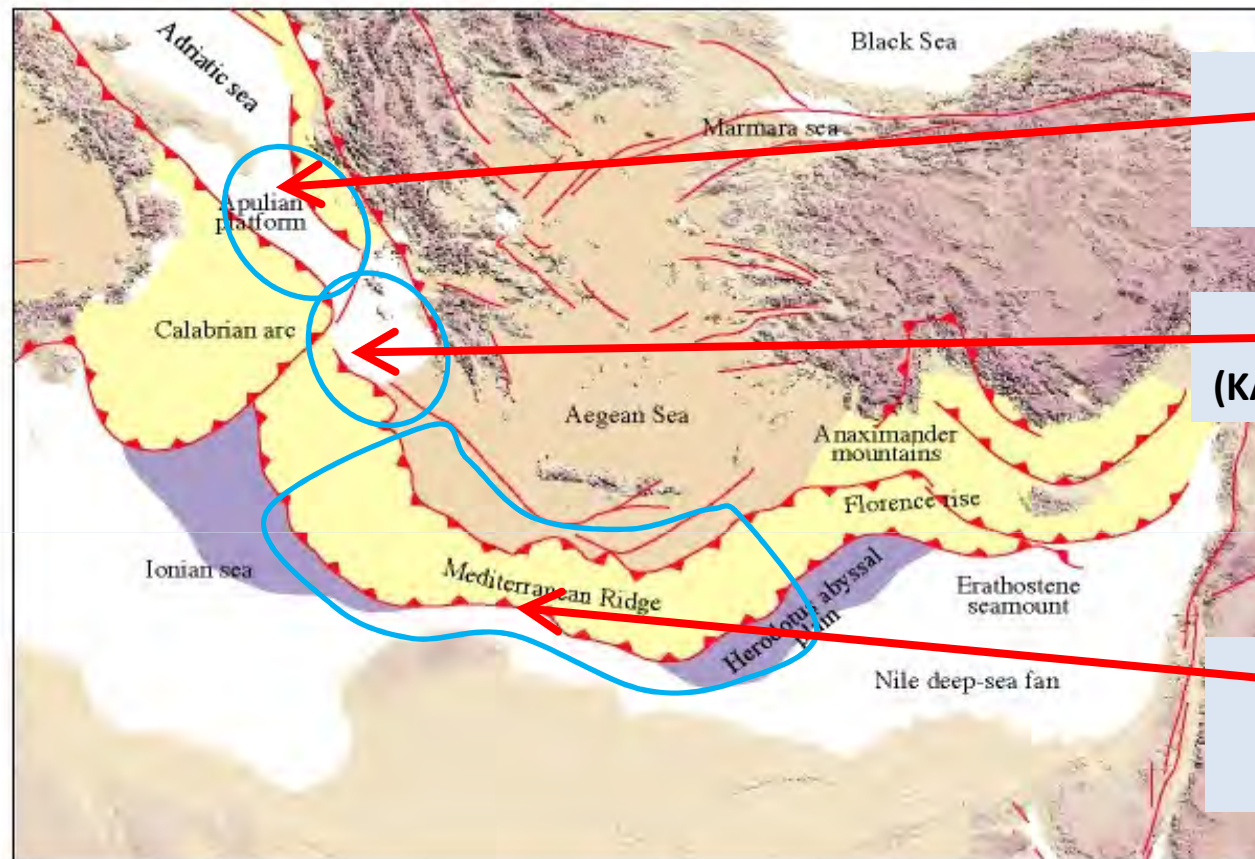


**PATRAIKOS GULF:
SEISMIC LINE
WITH
NEO-DIAPIRISM
of TRIASSIC
EVAPORITES**

Play concept
K NIKOLAOU



TECTONIC SKETCH OF EASTERN MEDITERRANEAN



**NORTH IONIAN SEA
(SOUTH ADRIATIC/APULIAN
PLATFORM)**

**CENTRAL IONIAN SEA
(KATAKOLON - PATRAIKOS GULF)**

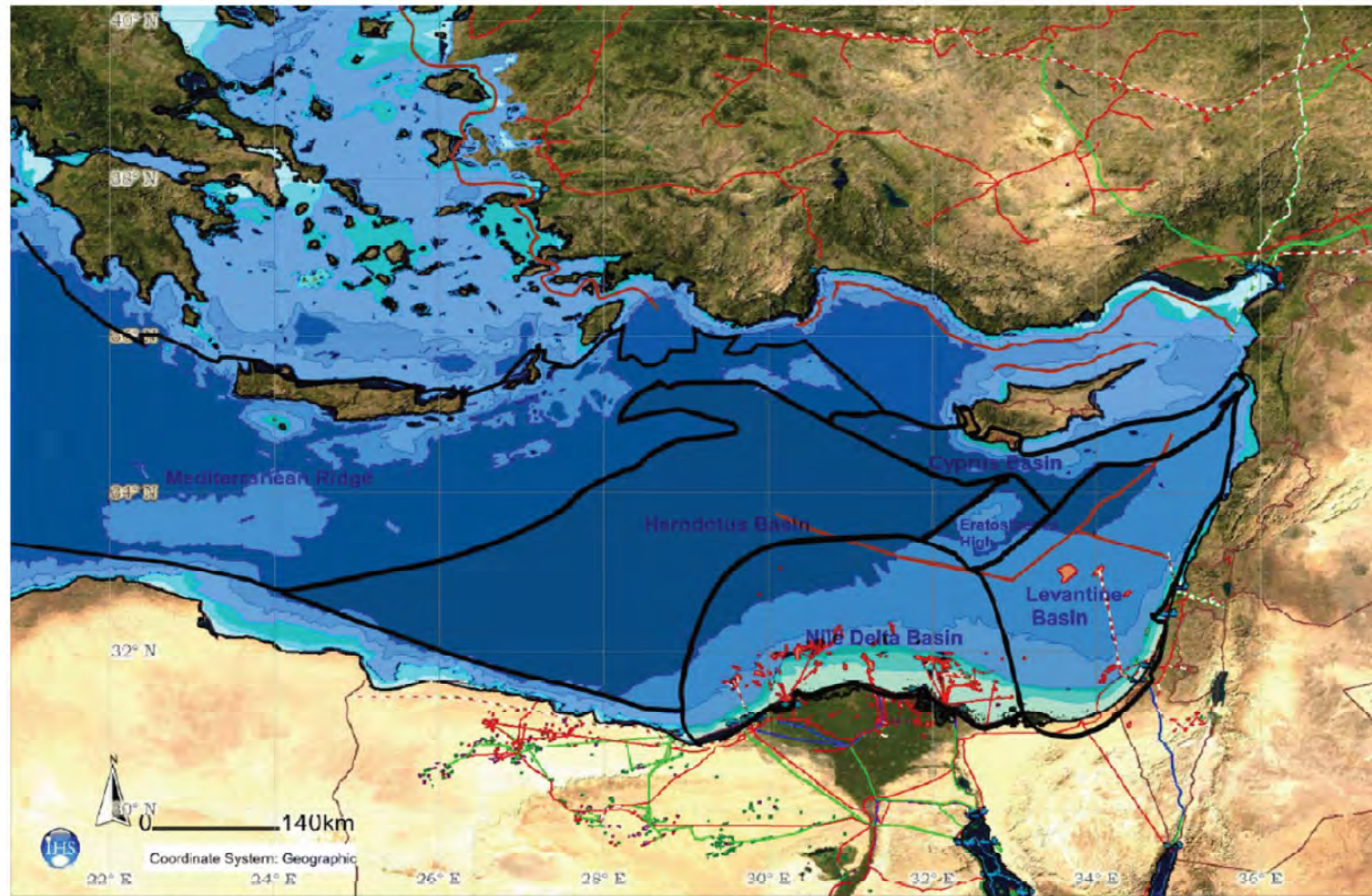
**SOUTH IONIAN and
SOUTH CRETE AREA
???**

Tectonic sketch of the Eastern Mediterranean

(adapted from Barrier, E., Chamot-Rooke, N. and Giordano, G., 2004,

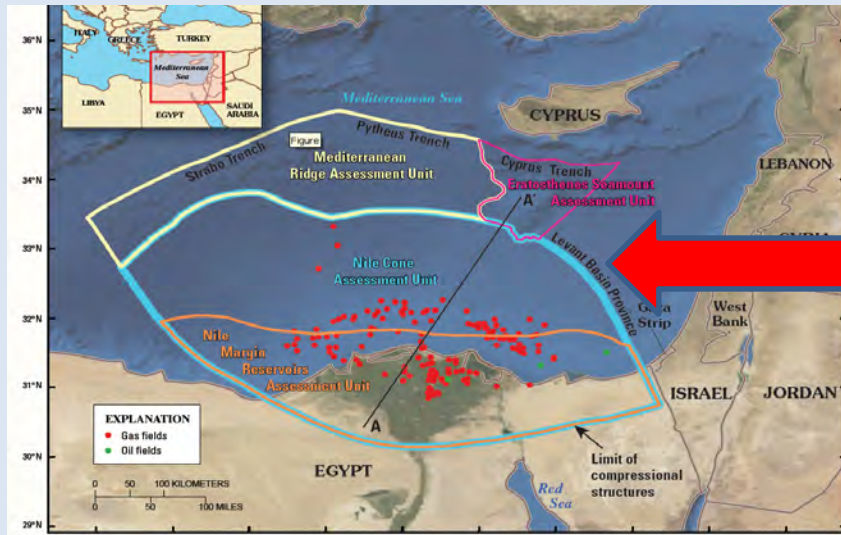
Geodynamic Map of the Mediterranean, Commission for The Geological Map of the World, CCGM)

EAST MEDITERRANEAN SUB-BASINS

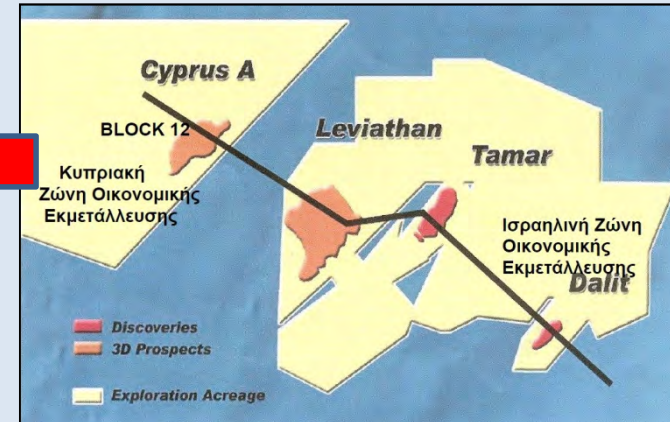


EDIN, version 6.3.2. Copyright © IHS Inc., 2011. All Rights Reserved. - Date: December 2011 - Author: Aristotelis Pagoulatos

Egypt: Offshore discoveries in Eastern Mediterranean



ISRAEL: Offshore Discoveries in Levantine Basin

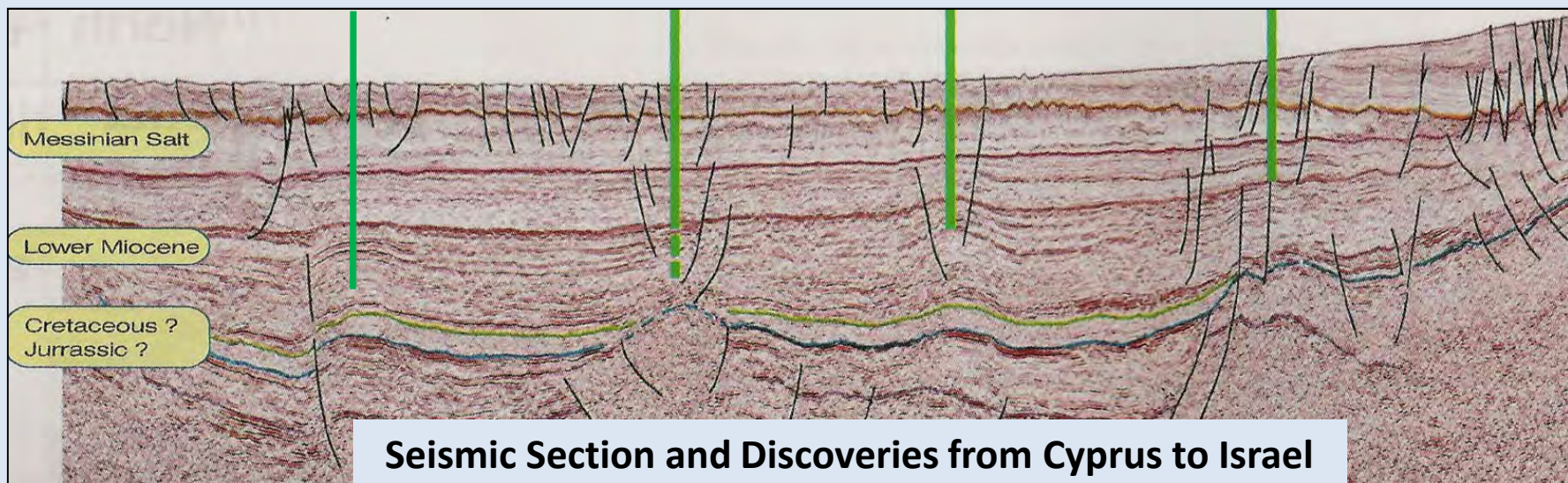


Cyprus A
7 + Tcf

Leviathan
≈ 16 + Tcf

Tamar
≈ 8+ Tcf

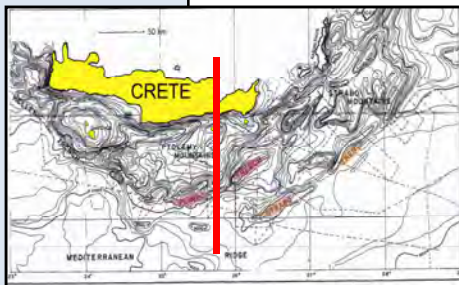
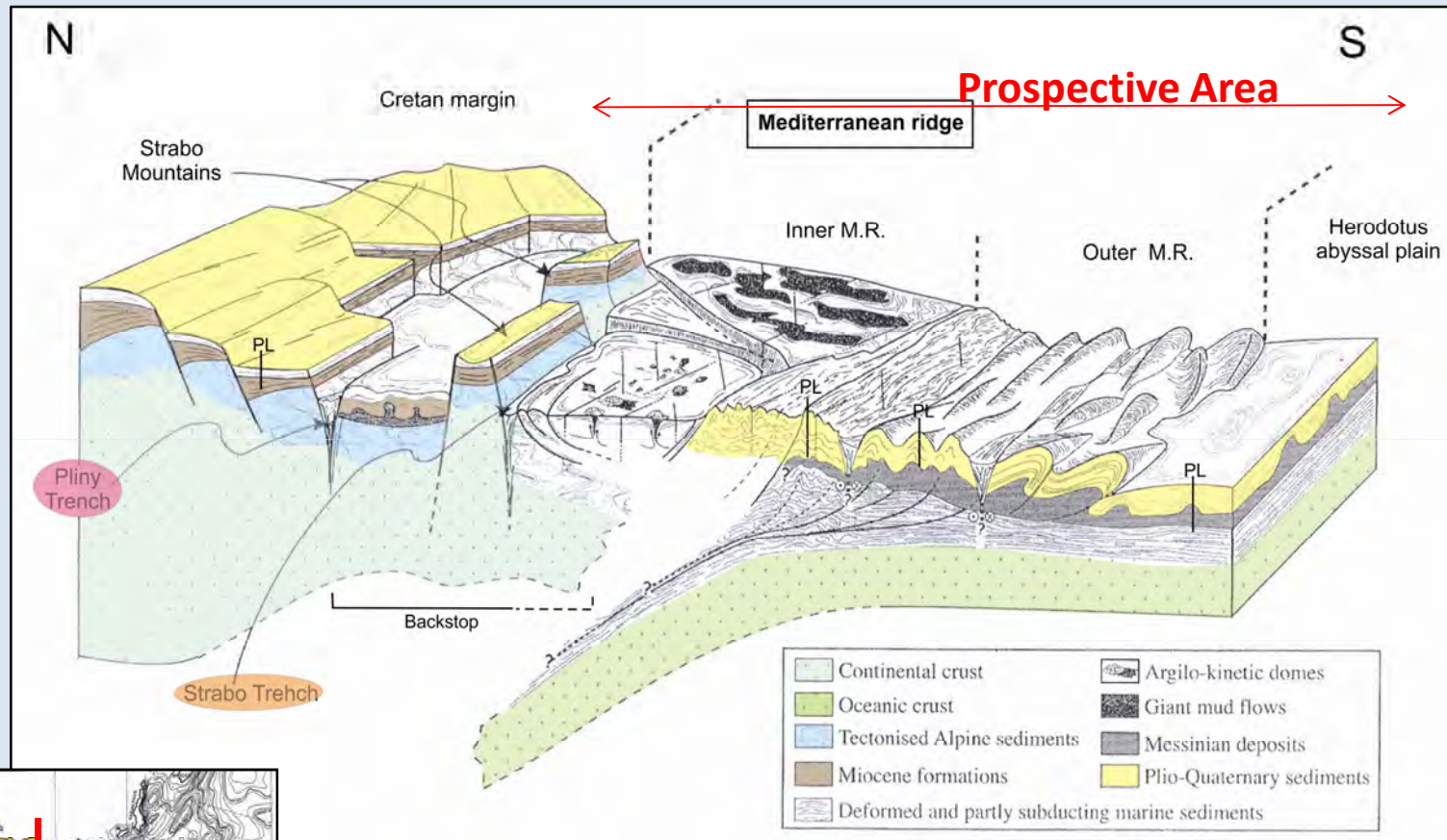
Dalit
≈ 0.5 Tcf



Seismic Section and Discoveries from Cyprus to Israel

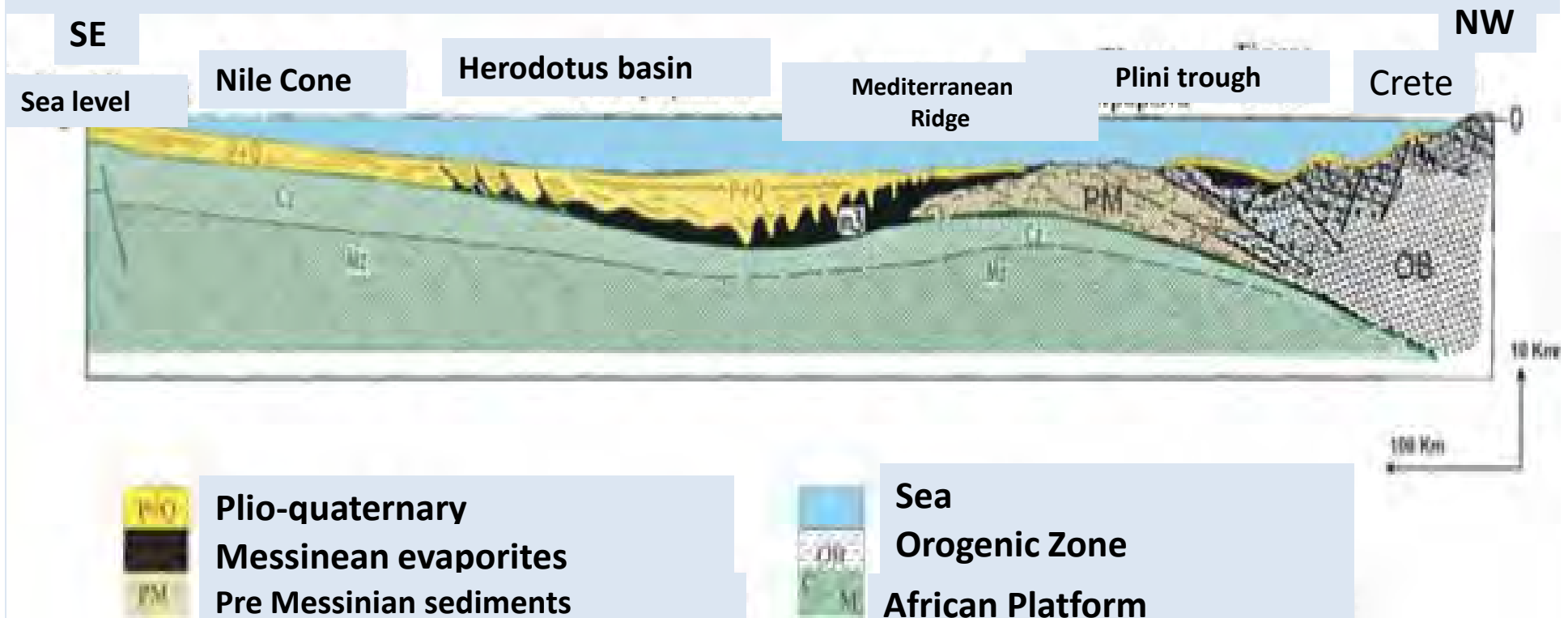
Greece : Exploration Potentiality of Southern Crete

General Geological Model



Huguen et al (2001)

Geological Cross Section CRETE-NORTH EGYPT (Nile Cone) Herodotus and Plinius Basins



PETROLEUM SYSTEM and POSSIBILITY OF SUCCESS (POS-%)

Examples from Patraikos Gulf and the area South of Crete

Elements of Petroleum System	Patraikos Block	South of Crete
Source	0.6	0.3
Reservoir	0.5	0.4
Trap	0.8	0.4
Seal	0.7	0.4
Migration (timing)	0.6	0.4
Possibility Of Success	≈ 10 %	< 3 %
Estimated Drilling Costs	\$30MM	\$100MM

ΥΠΟΣΤΗΡΙΚΤΙΚΑ

Petroleum Resources Classification

(ΟΡΟΛΟΓΙΑ ΠΕΤΡΕΛΑΪΚΩΝ ΑΠΟΘΕΜΑΤΩΝ)

(SPE/ AAPG/ WPC/ SPEE)

Αρχικά Επιτόπια Αποθέματα (Total Petroleum Initially in Place (PIIP))	Ανακαλυφθέντα (Discovered PIIP)	Εκμεταλλεύσιμα (Commercial)	ΠΑΡΑΓΩΓΗ (PRODUCTION)		
			ΑΠΟΘΕΜΑΤΑ (RESERVES)		
			Βεβαιωμένα (Proved) 1P	Δυνατά (Probable) 2P	Πιθανά (Possible) 3P
		Υπό όρους εκμεταλλεύσιμα (SB- Commercial)	ΔΥΝΗΤΙΚΟΙ ΠΟΡΟΙ (CONTIGENT RESOURCES)		
			1C	2C	3C
	Μη ανακαλυφθέντα (Undiscovered PIIP)	ΜΗ ΑΠΟΛΗΨΙΜΑ (UNRECOVERABLE)			
		ΑΝΑΜΕΝΟΜΕΝΟΙ ΠΟΡΟΙ (PROSPECTIVE RESOURCES)			
		Συντηρητική Εκτίμηση (Low Estimate)	Μέση Εκτίμηση (Best Estimate)	Υψηλή Εκτίμηση (High Estimate)	
		ΜΗ ΑΠΟΛΗΨΙΜΑ (UNRECOVERABLE)			

Βαθμός Αβεβαιότητας (Range of Uncertainty)

Αυξανόμενη Πιθανότητα Εκμετάλλευσης
(Increasing Chance of Commerciality)