

Italy Mesozoic Oils - Implications for Exploration in the Adriatic Sea*

Enzo Zappaterra¹

Search and Discovery Article #50839 (2013)**

Posted August 19, 2013

*Adapted from oral presentation given at AAPG European Regional Conference & Exhibition, Barcelona, Spain, April 8-10, 2013

**AAPG©2013 Serial rights given by author. For all other rights contact author directly.

¹Global Exploration Services Ltd., London, United Kingdom (enzozapp@aol.com)

Abstract

Italy Mesozoic oils display great variability of physical, chemical and geochemical properties, which is generally attributed to the depositional and tectonic development of the specific basin in which the oils are found. Oils and thermogenic gases discovered to date have been generated principally from three main source bed intervals: Middle Triassic; Late Triassic- Early Jurassic (Liassic); Cretaceous.

Based on API gravity distribution, Mesozoic oils in fields/discoveries onshore-offshore can be broadly grouped into four families: Light oils to condensate: 55-35; Medium to light: 34-23; Heavy: 22-12; and Extra heavy: 11- 4 API.

All Po basin oils are light, with API gravities exceeding 36 (Malossa), with the exception of Cavone (20-23 API). Light oils occur also in Sicily (Palma) and in the southern Apennines (Monte Alpi). Light oils are contained in both shallow water platform carbonates and in deeper water pelagic carbonates.

Medium to light oils are present in the Central Apennines/Adriatic (Miglianico), in the Southern Adriatic (Aquila), and in Sicily (Mila). These oils are preferentially found in breccias/packstones within Cretaceous/Jurassic pelagic limestone sequences. The exception is Mila, which contains oil in Triassic platform carbonates.

Most of the heavy/extra heavy oils occur in the Central Adriatic (Rospo) and in Sicily (Ragusa, Gela). Significant occurrences are also in the Southern Apennines (Costa Molina, Tempa Rossa). These oils are generally reservoirized in Triassic to Late Cretaceous platform carbonates, with the exception of Gianna and Elsa (Central Adriatic), which contain oil in pelagic carbonates of Cretaceous-Eocene age.

Producing levels occur within a wide range of depths, from 1,300 m (Rospo) to 5,600 m (Malossa). Although most light oils are found at greater depths than most heavy oils, Italy Mesozoic oils display no apparent direct correlation between oil gravity and reservoir depth, as a number of heavy oils occur at similar great depths: Costa Molina (13-21 API, 4,000 m), Tempa Rossa (15-21, 5,000-5,300 m), Gorgoglione (18, deeper than 4,000 m); and Prezioso (16, 4,800 m).

Heavy oils are often found in close proximity to light oils. Notable occurrences are in Sicily, where the heavy Gela (6- 10) and Ragusa (19 API) oils are close to the light oils of onshore Irminio (36-43); in the Southern Apennines, where the Monte Alpi light oil (30-42 API) is not far from the heavy oils of Tempa Rossa (15-21) and Costa Molina (13-21); and in the Central Adriatic, where the Elsa and Miglianico oils, although in close proximity, have API gravity of 12-15 and 34-37, respectively.

Most of the Central-Southern Adriatic displays a platform-to-basin sedimentary sequence consisting of Triassic-Liassic platform carbonates overlain by Middle Jurassic-Cretaceous deep-water basin micrites/marls. In contrast, an essentially uniform platform sequence (Apulian Platform) of Triassic-Cretaceous (locally Miocene) is developed along the western margin of the Central and Southern Adriatic Sea.

Both sequences have exploration potential for light and heavy oil accumulations. Thick oil columns may occur in reservoirs at the top of platform carbonate units, whereas thinner reservoirs may be developed in slope-to-basin turbidites, with correspondingly shorter hydrocarbon columns and smaller OOIP reserves. These slope-to-basin plays are prospective over large areas of the Adriatic Sea, mainly along the eastern margin of the Apulian platform, but also in areas farther to the east.

Selected References

Bertello, F., R. Fantoni, and R. Franciosi, 2008, Overview of the Italy's petroleum systems and related oil and gas occurrences: Conference and Technical Exhibition European Association of Geoscientists and Engineers, p. Abstract 9634.

Bertello, F., R. Fantoni, R. Franciosi, V. Gatti, M. Ghielmi, and A. Pugliese, 2010, From thrust-and-fold belt to foreland; hydrocarbon occurrences in Italy, in B.A. Vining, and S.C. Pickering, (eds.), *Petroleum geology; from mature basins to new frontiers; proceedings of the 7th petroleum geology conference: Petroleum Geology Conference Proceedings*, v. 7, p. 113-126.

AAPG EUROPEAN REGIONAL CONFERENCE

BARCELONA, 8-10 APRIL, 2013

ITALY MESOZOIC OIL

Implications for exploration in the Adriatic Sea





Introduction

Those familiar with the geology and exploration history of Italy are aware of the great variability in physical, chemical & geochemical properties of Mesozoic oils.

Variability attributed to the depositional & tectonic development of the basin in which these immature, sulphur-rich crude oils are found.

API gravity distribution forms the basis for the classification of oils into different categories.

Focus of this presentation:

- Relationships of API gravities of crude oils with:
 - ** Depositional facies of reservoirs in which oils are contained;
 - ** Depth to top of reservoirs.

Objectives:

- To determine patterns of gravity distributions, if any;
- To determine if established patterns can be used to predict type of petroleum occurrence ;
- ***Apply results to exploration drilling in the Adriatic Sea.***



...First offshore oil production...

Using sponges to collect naphtha from the surface of the waves



*Naphtha Bituminis est liquidi genus:
in mare manat Montibus e' Siculis,
fluidisque supernatat undis.*

*Spongia eam excipiunt Nautae,
expressamque recundunt Ollis,
ut varios hominum seruentur in usus.*

**Bitumen naphtha is a kind of liquid:
it flows into the sea from the mountains
of Sicily and floats on top of the waves.**

**Seamen collect it with sponges and,
after squeezing them out, they store it
in pots for people to use it in various ways.**

Giovanni Stradano (1523-1605)

Seep near Agrigento in Sicily reported in the 1st Century BC by the greek physician Dioscorides: "bitumen is found in its liquid state near Acragantium in Sicily. It floats on the surface of springs and is used in lamps instead of olive oil".



Italy Mesozoic oils

Oil gravity distribution

ITALY MESOZOIC OILS

API	Oil Field	Basin/Area	Formation
G	MALOSSA	Po basin	U. Triassic Dolomia Principale
	VILLAFORTUNA	Po basin	Middle Triassic (Meride)
	BENEVENTO	S. Apennines	UK/Miocene Apulian platform
	IRMINIO		
	VILLA FORTUNA	Po basin	Middle Triassic (Meride)
	PALMA	Sicily	Liassic (Modica)
	TRECCATE	Po basin	Middle Triassic (Meride)
	MONTE ALPI (30-42)	So. Apennines	UK/Miocene Apulian platform
	ARETUSA (35-38)	Sicily	Mid-U. Jurassic (Villagonia)
	GAGGIANO	Po basin	Middle Triassic (Meride)
R	IRMINIO	Sicily	U. Triassic Noto
	CERRO FALCONE	So. Apennines	UK/Miocene Apulian platform
A	MIGLIANICO (34-37)	Central Apennines	L. Cretaceous (Maiolica)
	MILA	Sicily	Triassic platform
	AQUILA (22-36)	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)
V	ROVESTI (25-27)	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)
	CAVONE (20-23)	Po basin	LK Breccia/Liassic platf.
	SANTA MARIA MARE	Adriatic	UK/Eocene (Scaglia)
I	PIROPO	Central Apennines	UK/Paleocene (Scaglia)
	COSTA MOLINA (13-21)	So. Apennines	UK/Miocene Apulian platform
	PERLA (14 - 20)	Sicily	Liassic platform
	RAGUSA		Triassic platform
	GORGOLIONE		UK/Miocene Apulian platform
	TEMPA ROSSA (15-21)	So. Apennines	UK/Miocene Apulian platform
	PREZIOSO		UK/Miocene Apulian platform
	VEGA (12-16) & PERLA	Sicily	Liassic platform
	ELSA (12-15)		Liassic platform (Siracusa)
	GIANNA (6-18)		L. Cretaceous (Maiolica)
T	NASELLO	Central Adriatic	UK/Eocene (Scaglia)
	ROSSO		LK Apulian platform (Cupello)
			LK Apulian platform (Cupello)
Y	PONTE DIRILLO	Sicily	K platform?
	EMILIO (4-16, avg. 12)	Central Adriatic	UK/Eocene ? (Scaglia, Maiolica)
	GELA (6-10)		
	CAMMARATA (7-16?)	Sicily	Triassic platform
	DAVID		UK/Eocene ? (Scaglia, Maiolica)
	GIANNA (5-7, 18?)	Central Adriatic	UK/Eocene (Scaglia)
	EMMA		UK/Eocene ? (Scaglia, Maiolica)

Ombrina Mare 16-15	Reservoir Facies	Platform (shelf) carbonates domain
K&E8 14		Pelagic domain - Slope, base of slope, basin
Sarago 7		

Wide spectrum of API gravities.

Four groups based on gravity distribution:

- Light gravity oils to condensate: > 35° API
- Medium gravity oils: 23°-34° API
- Heavy gravity oils: 11°-22° API
- Extra heavy gravity oils: < 10° API

Well-defined gravity segregation, with heavy oil at the base and lighter oil at the top, in a number of fields:

- ** Aquila, So. Adriatic (22°-36° API);
- ** Monte Alpi (30°-42° API);
- ** Tempa Rossa (15°-21° API) So. Apennines

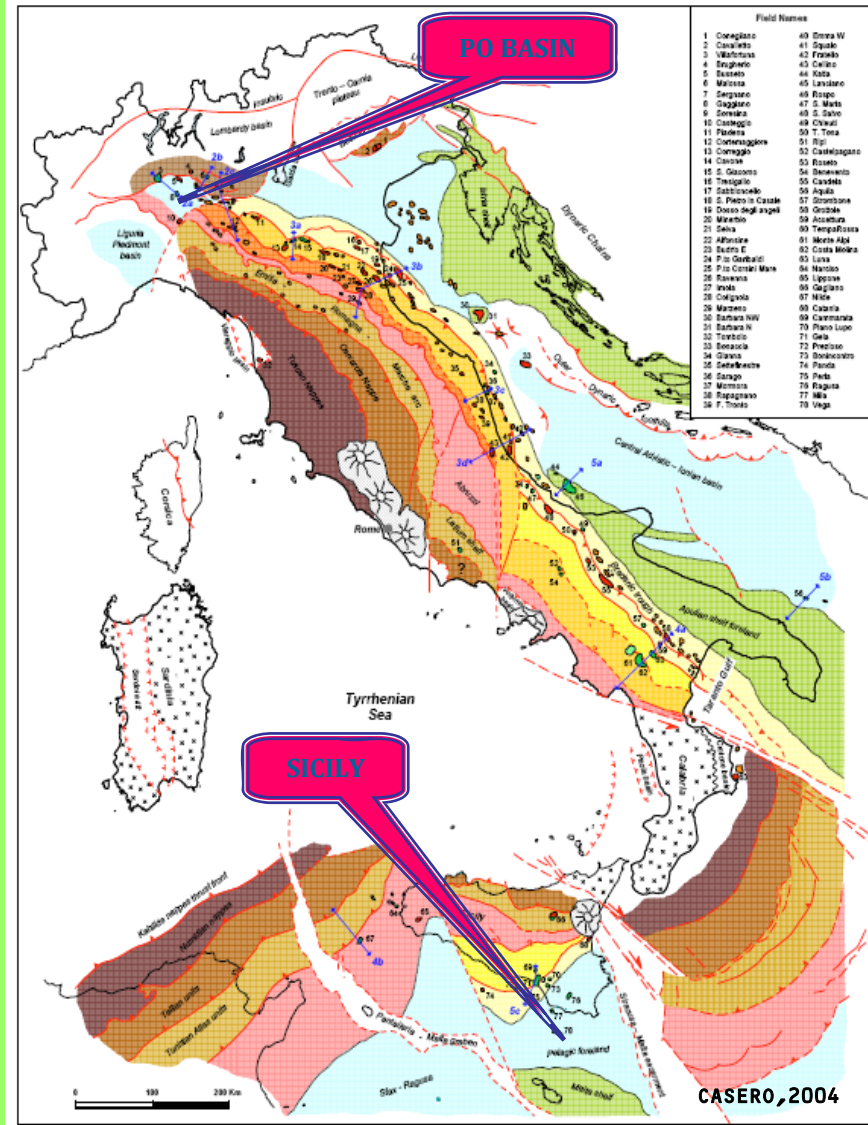


Italy Mesozoic oils

Geographic distribution

ITALY MESOZOIC OILS

API	Oil Field	Basin/Area	Formation
LO	MALOSSA	Po basin	U. Triassic Dolomia Principale
	VILLAFORTUNA		Middle Triassic (Meride)
	TRECCATE GAGGIANO		
MO	CAVONE (20-23)		LK Breccia/Liassic platf.
MO	AQUILA (22-36) ROVESTI (25-27)	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)
	SANTA MARIA MARE	Adriatic	UK/Eocene (Scaglia)
HO	ELSA (12-15) GIANNA (6-18)	Central Adriatic	L. Cretaceous (Maiolica) UK/Eocene (Scaglia)
	NASELLO ROSPO		LK Apulian platform (Cupello)
	EMILIO (4-16, avg. 12)		UK/Eocene (Scaglia)
EHO	DAVID GIANNA (5-7, 18?) EMMA		UK/Eocene (Scaglia) UK/Eocene (Scaglia)
	BENEVENTO MONTE ALPI (30-42) CERRO FALCONE	S. Apennines	UK/Miocene Apulian platform
MO	MIGLIANICO (34-37) PIROPO (23)	C. Apennines	L. Cretaceous (Maiolica) UK/Paleocene (Scaglia)
HO	COSTA MOLINA (13-21) GORGOLIONE TEMPA ROSSA (15-21)	So. Apennines	UK/Miocene Apulian platform
LO	PALMA ARETUSA (35-38) IRMINIO	Sicily	Liassic (Modica) Mid-U. Jurassic (Villagonia) U. Triassic Noto
	MILA		Triassic platform
HO	PERLA (14 - 20) RAGUSA PREZIOSO		Liassic platform Triassic platform Liassic platform
	VEGA (12-16) & PERLA		Liassic platform (Siracusa)
	PONTE DIRILLO		K platform?
EHO	GELA (6-10) CAMMARATA (7-16?)		





Geographic Distribution

Light oils & condensate

ITALY MESOZOIC OILS

API	Oil Field	Basin/Area	Formation
LO	MALOSSA VILLAFORTUNA TRECATE GAGGIANO	Po basin	U. Triassic Dolomia Principale
MO	CAVONE (20-23)		Middle Triassic (Meride)
			LK Breccia/Liassic platf.
MO	AQUILA (22-36) ROVESTI (25-27) SANTA MARIA MARE	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)
		Adriatic	UK/Eocene (Scaglia)
HO	ELSA (12-15) GIANNA (6-18) NASELLO ROSPO	Central Adriatic	L. Cretaceous (Maiolica) UK/Eocene (Scaglia)
			LK Apulian platform (Cupello)
EHO	EMILIO (4-16, avg. 12) DAVID GIANNA (5-7, 18?) EMMA		UK/Eocene (Scaglia) UK/Eocene (Scaglia) UK/Eocene (Scaglia)
LO	BENEVENTO MONTE ALPI (30-42) CERRO FALCONE	S. Apennines	UK/Miocene Apulian platform
MO	MIGLIANICO (34-37) PIROPO (23)	C. Apennines	L. Cretaceous (Maiolica) UK/Paleocene (Scaglia)
HO	COSTA MOLINA (13-21) GORGOGLIONE TEMPA ROSSA (15-21)	So. Apennines	UK/Miocene Apulian platform
LO	PALMA ARETUSA (35-38) IRMINIO	Sicily	Liassic (Modica) Mid-U. Jurassic (Villagonia) U. Triassic Noto
MO	MILA		Triassic platform
HO	PERLA (14 - 20) RAGUSA PREZIOSO VEGA (12-16) & PERLA		Liassic platform Triassic platform Liassic platform Liassic platform (Siracusa)
EHO	PONTE DIRILLO GELA (6-10) CAMMARATA (7-16?)		K platform? Triassic platform

All Po basin oils are light, with API gravity >36°. Exception: Cavone.

Light oils found also in the So. Apennines & Sicily.

Depositional facies:

-- Po basin & So. Apennines: oils contained in shallow water platform carbonates;

-- Off Sicily: in deeper water pelagic domains.



Geographic Distribution

Medium gravity oils

ITALY MESOZOIC OILS

API	Oil Field	Basin/Area	Formation
LO	MALOSSA VILLAFORTUNA TRECATE GAGGIANO	Po basin	U. Triassic Dolomia Principale
MO	CAVONE (20-23)		Middle Triassic (Meride)
MO	AQUILA (22-36) ROVESTI (25-27) SANTA MARIA MARE	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)
HO	ELSA (12-15) GIANNA (6-18) NASELLO ROSPO	Adriatic	UK/Eocene (Scaglia)
EHO	EMILIO (4-16, avg. 12) DAVID GIANNA (5-7, 18?) EMMA	Central Adriatic	L. Cretaceous (Maiolica) UK/Eocene (Scaglia) LK Apulian platform (Cupello)
LO	BENEVENTO MONTE ALPI (30-42) CERRO FALCONE	S. Apennines	UK/Miocene Apulian platform
MO	MIGLIANICO (34-37) PIROPO (23)	C. Apennines	L. Cretaceous (Maiolica) UK/Paleocene (Scaglia)
HO	COSTA MOLINA (13-21) GORGOGLIONE TEMPA ROSSA (15-21)	So. Apennines	UK/Miocene Apulian platform
LO	PALMA ARETUSA (35-38) IRMINIO	Sicily	Liassic (Modica) Mid-U. Jurassic (Villagonia) U. Triassic Noto
MO	MILA		Triassic platform
HO	PERLA (14 - 20) RAGUSA PREZIOSO VEGA (12-16) & PERLA		Liassic platform Triassic platform Liassic platform Liassic platform (Siracusa)
EHO	PONTE DIRILLO GELA (6-10) CAMMARATA (7-16?)		K platform? Triassic platform

Present in the Po basin, Adriatic, Central Apennines and Sicily.

Depositional facies: Preferential association with calciturbidites, detrital breccias and packstones within pelagic limestone/marl sequences of Cretaceous and Jurassic age.

Exception: Mila, offshore Sicily, which contains oils in Triassic platform carbonates.



Geographic Distribution

Heavy & extra heavy gravity oils

ITALY MESOZOIC OILS

API	Oil Field	Basin/Area	Formation		
LO	MALOSSA VILLAFORTUNA TRECATE GAGGIANO	Po basin	U. Triassic Dolomia Principale		
			Middle Triassic (Meride)		
			LK Breccia/Liassic platf.		
MO	CAVONE (20-23)				
MO	AQUILA (22-36) ROVESTI (25-27) SANTA MARIA MARE	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)		
		Adriatic	UK/Eocene (Scaglia)		
HO	ELSA (12-15) GIANNA (6-18) NASELLO ROSPO	Central Adriatic	L. Cretaceous (Maiolica)		
			UK/Eocene (Scaglia)		
			LK Apulian platform (Cupello)		
EHO	EMILIO (4-16, avg. 12) DAVID GIANNA (5-7, 18?) EMMA	Central Adriatic	UK/Eocene (Scaglia)		
			UK/Eocene (Scaglia)		
			UK/Eocene (Scaglia)		
LO	BENEVENTO MONTE ALPI (30-42) CERRO FALCONE	S. Apennines	UK/Miocene Apulian platform		
		MO	MIGLIANICO (34-37) PIROPO (23)	C. Apennines	L. Cretaceous (Maiolica)
				UK/Paleocene (Scaglia)	
HO	COSTA MOLINA (13-21) GORGOGNONE TEMPA ROSSA (15-21)	So. Apennines	UK/Miocene Apulian platform		
		LO	PALMA ARETUSA (35-38) IRMINIO	Sicily	Liassic (Modica)
					Mid-U. Jurassic (Villagonia)
U. Triassic Noto					
MO	MILA		Triassic platform		
HO	PERLA (14 - 20) RAGUSA PREZIOSO VEGA (12-16) & PERLA	Sicily	Liassic platform		
			Triassic platform		
			Liassic platform		
			Liassic platform (Siracusa)		
EHO	PONTE DIRILLO GELA (6-10) CAMMARATA (7-16?)	Sicily	K platform?		
			Triassic platform		

Most heavy/extra heavy oils are found in the *Central Adriatic* and onshore-offshore Sicily.

Heavy oils in the So. Apennines: Costa Molina, Tempa Rossa, Gorgoglione.

Depositional facies: Generally reservoired in Triassic to Late Cretaceous shelf carbonates.

Exception: Gianna & Elsa, which contain oils in pelagic carbonates (Maiolica, Scaglia) of Cretaceous to Eocene age.



Depositional facies of producing reservoir levels

ITALY MESOZOIC OILS

API	Oil Field	Basin/Area	Formation
LO	MALOSSA	Po basin	U. Triassic Dolomia Principale
	BENEVENTO	So. Apennines	UK/Miocene Apulian platform
	VILLA FORTUNA	Po basin	Middle Triassic (Meride)
	TRECATE	So. Apennines	UK/Miocene Apulian platform
	MONTE ALPI (30-42)	So. Apennines	UK/Miocene Apulian platform
	GAGGIANO	Po basin	Middle Triassic (Meride)
	CERRO FALCONE (35-36)	So. Apennines	UK/Miocene Apulian platform
MO	MILA	Sicily	Triassic platform
HO	COSTA MOLINA (13-21)	So. Apennines	UK/Miocene Apulian platform
	PERLA (14 - 20)	Sicily	Liassic platform
	RAGUSA	Sicily	Triassic platform
	GORGOGNONE	So. Apennines	UK/Miocene Apulian platform
	TEMPA ROSSA (15-21)	So. Apennines	UK/Miocene Apulian platform
	PREZIOSO	Sicily	Liassic platform (Siracusa)
	VEGA (12-16) & PERLA	Sicily	Liassic platform (Siracusa)
NASELLO	Central Adriatic	LK Apulian platform (Cupello)	
ROSPO	Central Adriatic	LK Apulian platform (Cupello)	
EHO	PONTE DIRILLO	Sicily	K platform?
	GELA (6-10)	Sicily	Triassic platform
	CAMMARATA (7-16?)	Sicily	Triassic platform
LO	PALMA	Sicily	Liassic (Modica)
	ARETUSA (35-38)	Sicily	Mid-U.Jurassic (Villagonia)
	IRMINIO	Sicily	U. Triassic Noto
MO	MIGLIANICO (34-37)	Central Apennines	L. Cretaceous (Maiolica)
	AQUILA (22-36)	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)
	ROVESTI (25-27)	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)
	CAVONE (20-23)	Po basin	LK Breccia/Liassic platf.
	SANTA MARIA MARE	Adriatic	UK/Eocene (Scaglia)
	PIROPO	Central Apennines	UK/Paleocene (Scaglia)
HO	ELSA (12-15)	Central Adriatic	L. Cretaceous (Maiolica)
	GIANNA (6-18)	Central Adriatic	UK/Eocene (Scaglia)
EHO	DAVID	Central Adriatic	UK/Eocene? (Scaglia)
	GIANNA (5-7, 18?)	Central Adriatic	UK/Eocene (Scaglia)
	EMMA	Central Adriatic	UK/Eocene? (Scaglia)

So. Apennines & Sicily. Most heavy & extra heavy oils contained in Triassic to Late Cretaceous shelf carbonates.

Central-So. Adriatic: Medium gravity to extra heavy oils in Jurassic to Cretaceous detrital reservoirs within pelagic calcareous sequences; with the exception of Mila (Triassic platform).

Po basin, So. Apennines & Sicily. Light oils contained in both platform carbonates & pelagic carbonates.



Depth of producing reservoir levels

ITALY MESOZOIC OILS

API	Oil Field	Basin/Area	Formation	Top Reservoir (m.)	
LO	MALOSSA	Po basin	U. Triassic Dolomia Principale	5600 5500 5000 + 4600 2000-2500	
	VILLAFORTUNA		Middle Triassic (Meride)		
	TRECCATE				
	GAGGIANO				
MO	CAVONE (20-23)		LK Breccia/Liassic platf.		
MO	AQUILA (22-36)	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)	3850 2850-3350 2500	
	ROVESTI (25-27)		K/Jurassic (Scaglia, Mai., Apt.)		
	SANTA MARIA MARE	Adriatic	UK/Eocene (Scaglia)		
HO	ELSA (12-15)	Central Adriatic	L. Cretaceous (Maiolica)	4475 2000-2300 1300	
	GIANNA (6-18)		UK/Eocene (Scaglia)		
	NASELLO		LK Apulian platform (Cupello)		
	ROSPO				
EHO	EMILIO (4-16, avg. 12)		UK/Eocene? (Scaglia)	2500? - 3000	
	DAVID				
	GIANNA (5-7, 18?)		UK/Eocene (Scaglia)		
LO	BENEVENTO	So. Apennines	UK/Miocene Apulian platform	3000 + 2000-3000 4000	
	MONTE ALPI (30-42)				
	CERRO FALCONE				
MO	MIGLIANICO (34-37)	C. Apennines	L. Cretaceous (Maiolica)	4925	
	PIROPO (23)		UK/Paleocene (Scaglia)		
HO	COSTA MOLINA (13-21)	So. Apennines	UK/Miocene Apulian platform	4000 4000 + 5000-5300	
	GORGOGNONE				
LO	TEMPA ROSSA (15-21)				
	PALMA	Sicily	Liassic (Modica)	3270 2500 3500 2450 1400 4800 2440-2650 3440	
	ARETUSA (35-38)		Mid-U. Jurassic (Villagonia)		
IRMINIO	U. Triassic Noto				
MO	MILA		Triassic platform		
HO	PERLA (14 - 20)		Liassic platform		
	RAGUSA		Triassic platform		
	PREZIOSO		Liassic platform		
	VEGA (12-16) & PERLA		Liassic platform (Siracusa)		
EHO	PONTE DIRILLO				K platform?
	GELA (6-10)				
	CAMMARATA (7-16?)		Triassic platform		

Producing levels occurs within a wide range of depths, from 1300 m in Rospo Mare to 5600 m in Malossa.

Oils producing from depths >4000 m occur in the Po basin & So. Apennines (Val d'Agri), and have a preferential association with platform carbonates.

Although light oils (Po basin) are generally found at greater depths than most heavy oils, there is no apparent direct correlation between oil gravity and depth of reservoir.

A number of heavy & medium gravity oils found at similar great depths:

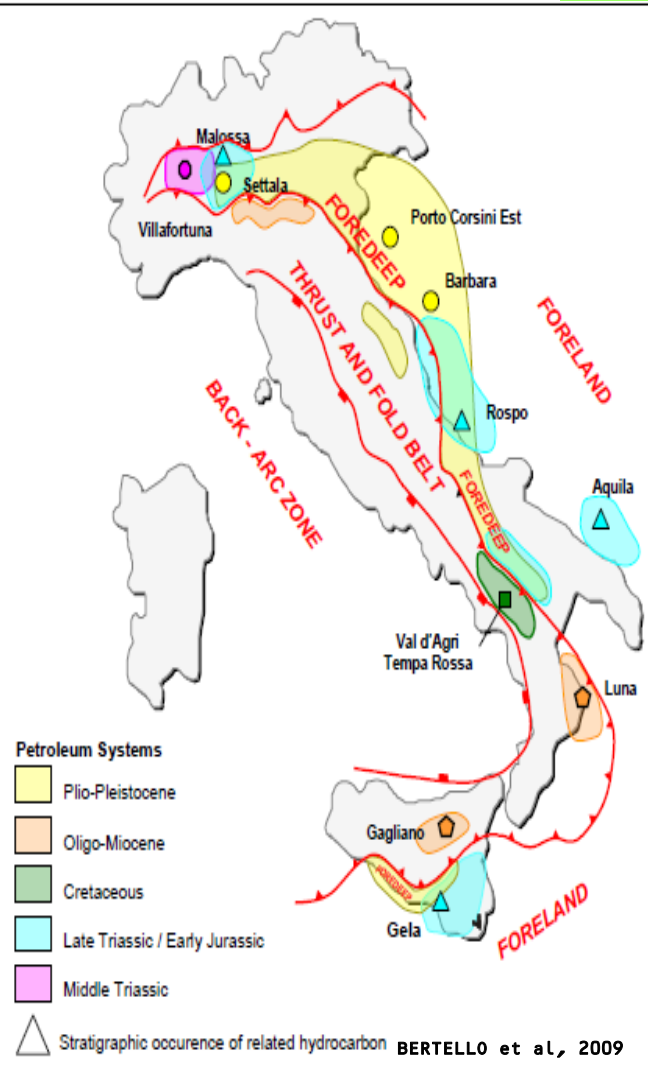
- Costa Molina: 13°-21° API, 4000 m
- Tempa Rossa: 15°-21°, 5000-5300 m
- Gorgoglione: 18°, deeper than 4000 m
- Prezioso: 16°, 4800 m
- Elsa: 12—15, 4475 m
- Miglianico, 34-37, 4925 m



Mesozoic oils & tectonic domains

ITALY MESOZOIC OILS

Tectonic Domain	API	Oil Field
Thrust belt	LO	MONTE ALPI (30-42) CERRO FALCONE
	HO	COSTA MOLINA (13-21) GORGOLIONE TEMPA ROSSA (15-21)
	LO	MALOSSA
		VILLAFORTUNA
BENEVENTO		
IRMINIO		
PALMA		
ARETUSA (35-38)		
TRECATE GAGGIANO		
MO	MIGLIANICO (34-37)	
	MILA	
	CAVONE (20-23)	
	SANTA MARIA MARE	
	PIROPO (23)	
HO	ELSA (12-15)	
EHO	EMILIO (4-16, avg. 12)	
	DAVID	
	GIANNA (5-7, 18?)	
	EMMA	
MO	AQUILA (22-36)	
	ROVESTI (25-27)	
	PERLA (14 - 20)	
	RAGUSA PREZIOSO	
	VEGA (12-16) & PERLA	
	PONTE DIRILLO GELA (6-10)	
EHO	CAMMARATA (7-16?)	
HO	ROSPO	
	NASELLO	



Note the occurrence of heavy oils next to light oils

No apparent direct relationship between oil gravity and tectonic domain.

Except for oils in the stable Apulian Foreland.

Greatest variability within the relatively unstable Pelagic Foreland to Foredeep domain.



Heavy oils next to light oils

ITALY MESOZOIC OILS

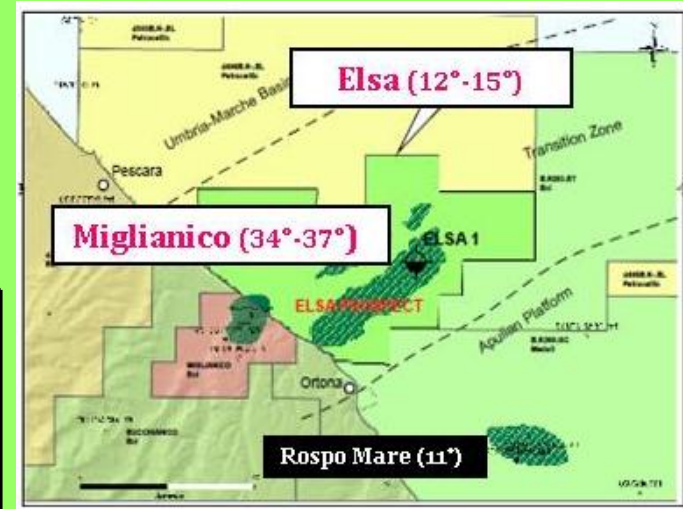
API	Oil Field	Basin/Area	Formation
LO	MALOSSA	Po basin	U. Triassic Dolomia Principale
	VILLAFORTUNA		Middle Triassic (Meride)
	TRECATE		
	GAGGIANO		
MO	CAVONE (20-23)	LK Breccia/Liassic platf.	

MO	AQUILA (22-36)	So. Adriatic	K/Jurassic (Scaglia, Mal., Apt.)
	ROVESTI (25-27)	Adriatic	UK/Eocene (Scaglia)
SANTA MARIA MARE			
HO	ELSA (12-15)	Central Adriatic	L. Cretaceous (Maiolica)
	GIANNA (6-18)		UK/Eocene (Scaglia)
	NASELLO		LK Apulian platform (Cupello)
	ROSPO		
EHO	EMILIO (4-16, avg. 12)	Central Adriatic	???
	DAVID		
	GIANNA (5-7, 187)		
	EMMA		

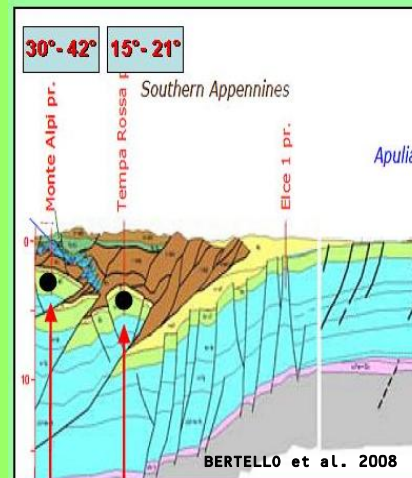
MO	BENEVENTO	S. Apennines	UK/Miocene Apulian platform
	MONTE ALPI (30-42)		
	CERRO FALCONE		
MO	MIGLIANICO (34-37)	C. Apennines	L. Cretaceous (Maiolica)
	PIROPO (23)	UK/Paleocene (Scaglia)	
MO	COSTA MOLINA (13-21)	So. Apennines	UK/Miocene Apulian platform
	GORGOGNONE		
	TEMPA ROSSA (15-21)		

MO	PALMA	Sicily	Liassic (Modica)
	ARETUSA (35-38)		Mid-U. Jurassic (Villagonia)
	IRMINIO		U. Triassic Noto
MILA	Triassic platform		
PERLA (14-20)	Liassic platform		
RAGUSA	Triassic platform		
PREZIOSO	Liassic platform		
VEGA (12-16) & PERLA	Liassic platform (Siracusa)		
PONTE DIRILLO	K platform?		
GELA (6-10)	Triassic platform		
CAMMARATA (7-167)	Triassic platform		

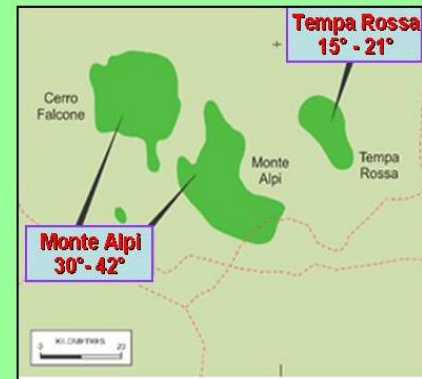
Molise-Central Adriatic.
Elsa heavy oil (12°-15°)
close to Miglianico medium
& light oil (34°-37°).



Sicily:
Extra heavy oil of Gela
(6°-10°) and heavy oil of
Ragusa (19°) are close to
the light oil of Irminio (36°-
43°).



So. Apennines (Val d'Agri)



Heavy oils of
Tempa Rossa
(15°-21°) &
Costa Molina
(13°-21°) next to
the light oils of
Monte Alpi (30°-
42°).



Conclusions

- Great variability of physical, chemical & geochemical properties of Mesozoic oils
 - Seemingly puzzling distribution of API gravities
 - No apparent direct oil gravity-depth relationship
 - Two main reservoir depositional facies
 - Light oil fields next to heavy oil fields
 - Well-defined gravity segregation with heavy oil at the base and lighter oil at the top:
 - ** Aquila, 22°-36° API, So. Adriatic;
 - ** Monte Alpi, 30°-42° API, So. Apennines
 - ** Tempa Rossa, 15°-21° API, So. Apennines
 - Mixing of different gravity oils suggests complex maturation and migration histories.
- *Variability attributed to depositional & tectonic development of the basin in which oils are found.*
 - ** Thermal/structural history;
 - ** Intense Neogene Alpine tectonics;
 - ** Kerogen type & depositional environment of source rocks.
 - *Source rocks.*
 - ** *Middle Triassic*: Po basin light oils;
 - ** *Late Triassic-Early Jurassic*: medium gravity & heavy oils of Central Apennines & So. Adriatic; and heavy-extra heavy oils of Sicily;
 - ** *Cretaceous*: light & heavy oils of the So. Apennines.
 - Unpredictable pre-drilling outcome.

*Implications for exploration in the Central
& Southern Adriatic Sea*





Basin setting

- Stratigraphy, Central-So. Adriatic:

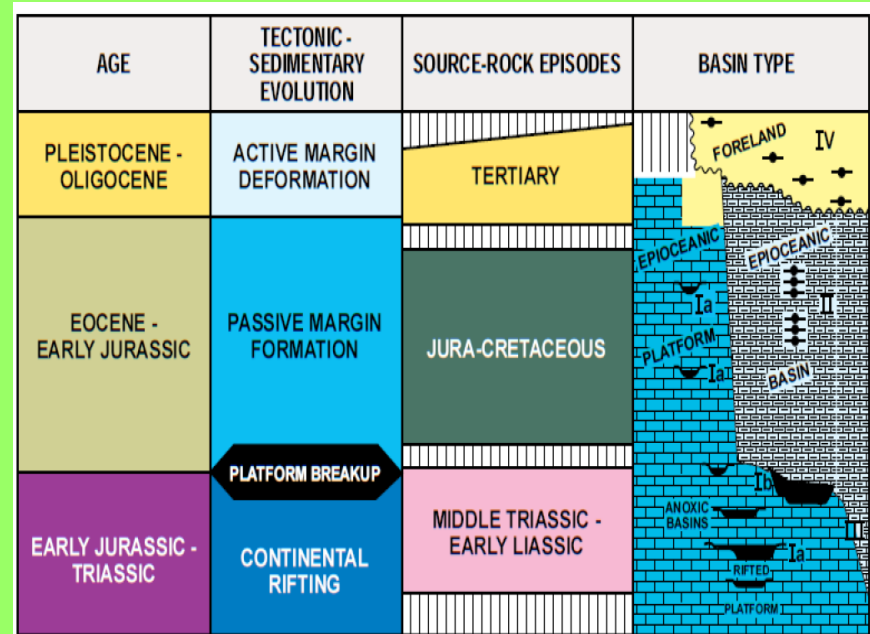
- ** *Pelagic Foreland*:

Platform-to-basin sedimentary sequence of shallow water Triassic-Liassic carbonates overlain by Middle Jurassic to Cretaceous deepwater basin micrites and other argillaceous carbonates .

- ** *Apulian Foreland*

In contrast, an essentially uniform platform sequence of Triassic-Cretaceous (locally Miocene) is developed along the western margin of the Central and So. Adriatic Sea (eastern margin of the Apulian Platform.

- Both sequences have oil potential.





Gravity distribution & tectonic domains of Adriatic oils

ADRIATIC OILS

API	Oil field	Basin/Area	Formation	top Reservoir (m)
MO	AQUILA (22-36)	So. Adriatic	K/Jurassic (Scaglia, Mai., Apt.)	3850
	ROVESTI (25-27)		K/Jurassic (Scaglia, Mai., Apt.)	2850-3350
	SANTA MARIA MARE	Adriatic	UK/Eocene (Scaglia)	2500
HO	ELSA (12-15)	Central Adriatic	L. Cretaceous (Maiolica)	4475
	GIANNA (6-18)		UK/Eocene (Scaglia)	2000-2300
	NASELLO		LK Apulian platform (Cupello)	1300
	ROSPO			
EHO	EMILIO (4-16, avg. 12)	Central Adriatic	UK/Eocene? (Scaglia)	2500? - 3000
	DAVID			
	GIANNA (5-7, 18?)		UK/Eocene (Scaglia)	
	EMMA		UK/Eocene? (Scaglia)	

No light oil reportedly found in the Adriatic

Most oils have middle to heavy-extra heavy API gravities

Oils display a preferential association with:

- basin pelagic facies;
- pelagic foreland & pelagic foreland-to-foredeep domains.

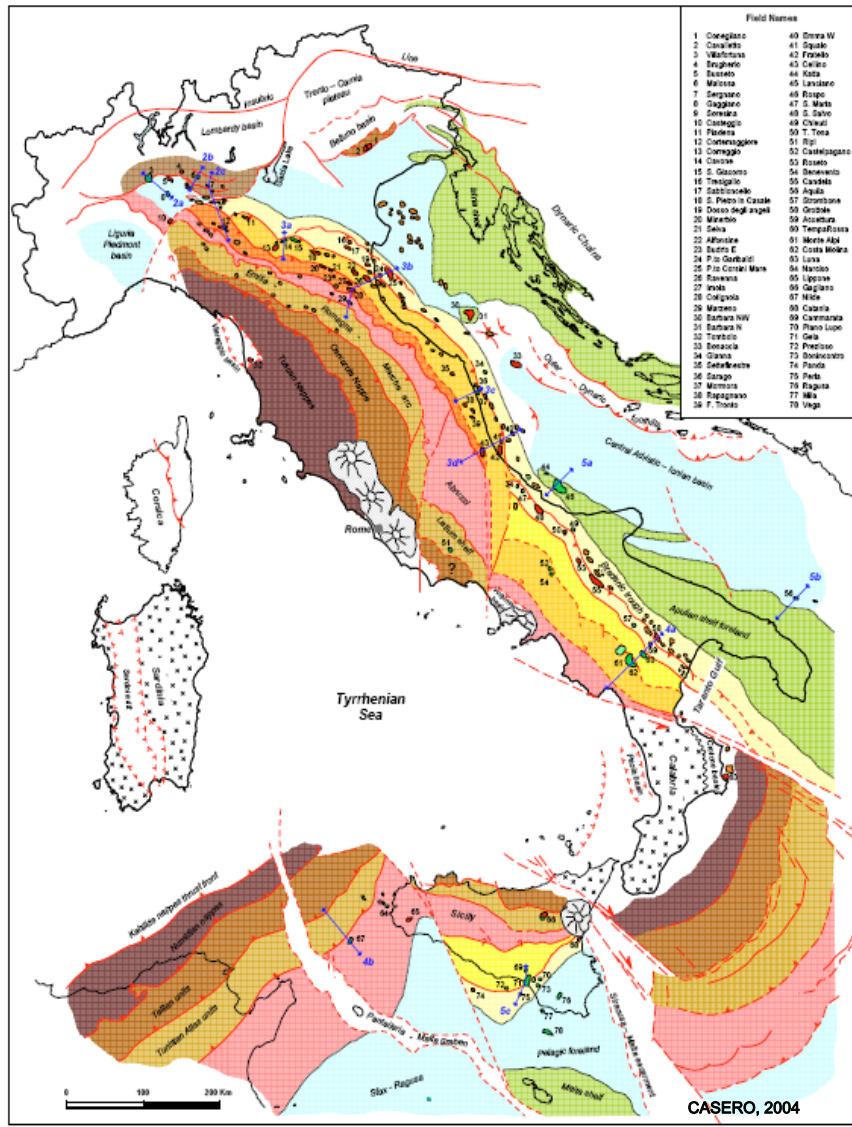
Expect more of the same

Elsa: only example to date of oil in reservoirs deeper than 4000 m.

Potential for heavy oil accumulations in reservoirs at depths greater than 4000 m.



Play type & play fairways



Play types & play fairways:

Play 1 – Platform margin play: breccias & calcareous turbidites (calciturbidites) along the slope to base-of-slope, embedded into pelagic micrites and marls.

Play 2 – Foreland play: karstified, fractured platform carbonates at the top of the Apulian platform.

Play 3 – Pelagic basin play: fractured pelagic micrites and potential turbidites within marls & calcareous mudstones.

Slope-to-basin plays are prospective over large areas of the Central & So. Adriatic, mainly along the eastern margin of the Apulian Platform, but also in areas farther to the east.

Relatively thinner net reservoirs expected in slope-to-basin and basin turbidites.

Thick oil columns may occur in platform carbonate reservoirs.



What if:

- * *Heavy oil is discovered in the Adriatic, at greater than normal depths (> 4000 m)?*
- * *Is recovery possible and economic?*

LO	BENEVENTO	S. Apennines	UK/Miocene Apulian platform	3000 +
	MONTE ALPI (30-42)			2000-3000
	CERRO FALCONE			4000
MO	MIGLIANICO (34-37)	C. Apennines	L. Cretaceous (Maiolica)	4925
	PIROPO (23)		UK/Paleocene (Scaglia)	
HO	COSTA MOLINA (13-21)	So. Apennines	UK/Miocene Apulian platform	4000
	GORGOGNONE			4000 +
	TEMPA ROSSA (15-21)			5000-5300
HO	RAGUSA	Sicily	Triassic platform	1400
	PREZIOSO		Liassic platform	4800

Based on the analogy with fields in the Central-So. Apennines (Val d'Agri) & Sicily, where heavy crude oil accumulations in carbonate reservoirs at depths between 4000 m and 5300 m have been successfully and economically exploited, economic recovery of potential heavy crude oil discoveries in the Adriatic is considered attainable.

Project economics critical for a successful outcome, as the heavy crude oil is sold at a discount compared to medium and light oils.

Profitability is a major risk, as heavy oil projects require higher costs of recovery (especially from deep reservoirs), transport & refining.

Risk may be mitigated by sustainable high oil prices that may improve the economic & profitability of heavy oil projects.

THANK YOU!



Global Exploration Services Ltd
Little Lower Ease
Cuckfield Road
Ansty
West Essex RH17 5AL
UK

For general information: Ray Bate, Managing Director, Ansty, UK

For exploration consulting services: Enzo Zappaterra, London, UK