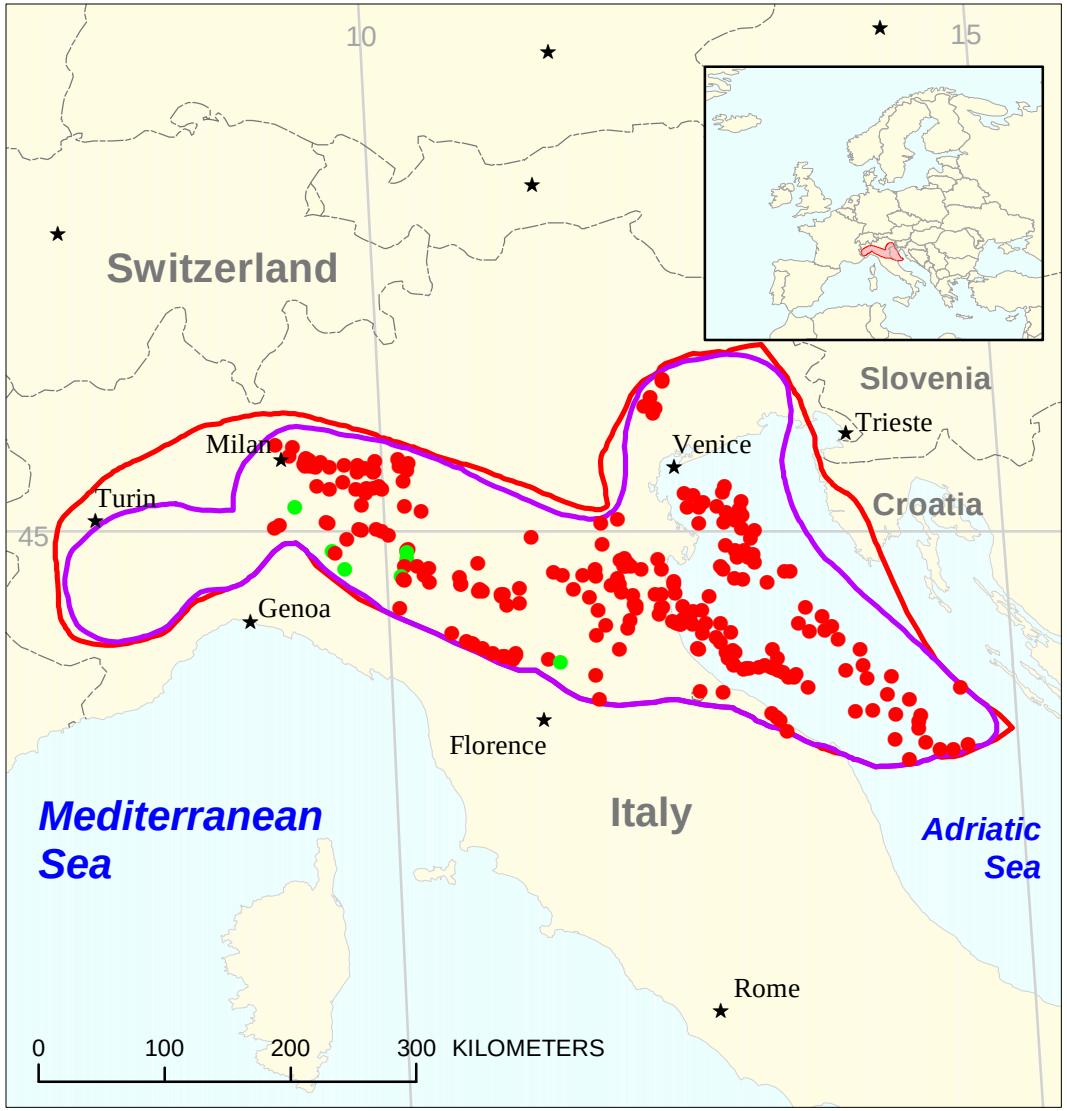
Go to Table of Contents

Go to index map

Neogene Flysch Gas Assessment Unit 40600101



Geologic Summary

Detailed map of this assessment unit

Exploration/Discovery-History Data

- Plots of Known Field Sizes
- Plots of Grown Resources
- Tables

Assessment Input Data

Assessment Results

- Assessment Unit Summary
- Detailed Assessment Results
- Undiscovered Field-Size Distributions

USGS PROVINCE: Po Basin (4060) **GEOLOGIST:** S.J. Lindquist

TOTAL PETROLEUM SYSTEM: Porto Garibaldi (406001)

ASSESSMENT UNIT: Neogene Flysch Gas (40600101) (established)

DESCRIPTION: Assessment unit covers the entire Neogene/Quaternary biogenic gas petroleum system as well as a Neogene thermal gas petroleum system of onshore northern Italy and offshore Italy and Croatia (northern Adriatic Sea). The Po Basin evolved from a post-Pangea, Mesozoic carbonate passive continental margin to a Tertiary siliciclastic collision zone. The assessment unit includes foreland and foredeep areas of the Alpine and Apennine Tertiary orogenic belts.

SOURCE ROCKS: The source of biogenic gas is gas-prone, deep-marine shales that are mainly Pliocene, with notable Pleistocene and minor Miocene contributions. Thermal gas, oil and condensate is sourced from deep-marine Miocene shales with mostly Type III kerogen.

MATURATION: Biogenic gas has been generated for the last several million years, is probably still being generated, and is preserved to depths of at least 4.5 km because of the cool Cenozoic thermal regime in this area. Thermal gas resulted from Pliocene subsidence to more than 6 km.

MIGRATION: Negligible migration is required for biogenic gas accumulations in interbedded reservoir rocks. Lateral, vertical, and fault migration is required for thermal hydrocarbon accumulations.

RESERVOIR ROCKS: Reservoirs are Neogene siliciclastic turbidite deposits with variable net-to-gross ratios but typically 30 percent porosity and hundreds of millidarcies permeability. Lesser shallow marine siliciclastics also are reservoirs.

TRAPS AND SEALS: Traps are stratigraphic (turbidites) and structural (Tertiary anticlines). Seals are deep-marine shales ranging in thickness from tens of meters to less than one meter, the latter of which probably leak even as replenishment occurs.

REFERENCES:

Anelli, L., Mattavelli, L., and Pieri, M., 1996, Structural-stratigraphic evolution of Italy and its petroleum systems, *in* Ziegler, P.A., and Horvath, F., eds., Peri-Tethys Memoir 2–Structure and prospects of alpine basins and forelands: Editions du Museum National d'Histoire Naturelle, v. 170, p. 455-483.

Lindquist, S.J., 1999, Petroleum systems of the Po Basin province of northern Italy and the northern Adriatic Sea–Port Garibaldi (biogenic), Meride/Riva di Solto (thermal), and Marnoso Arenacea (thermal): U.S. Geological Survey Open-File Report 99-50-M, 19 p., 15 figs., 3 tables.

Mattavelli, L., Novelli, L., and Anelli, L., 1991, Occurrence of hydrocarbons in the Adriatic basin *in* Spencer, A.M., ed., Generation, accumulation and production of Europe's hydrocarbons: Oxford University Press, Special Publication of the European Association of Petroleum Geoscientists no. 1, p. 369-380.

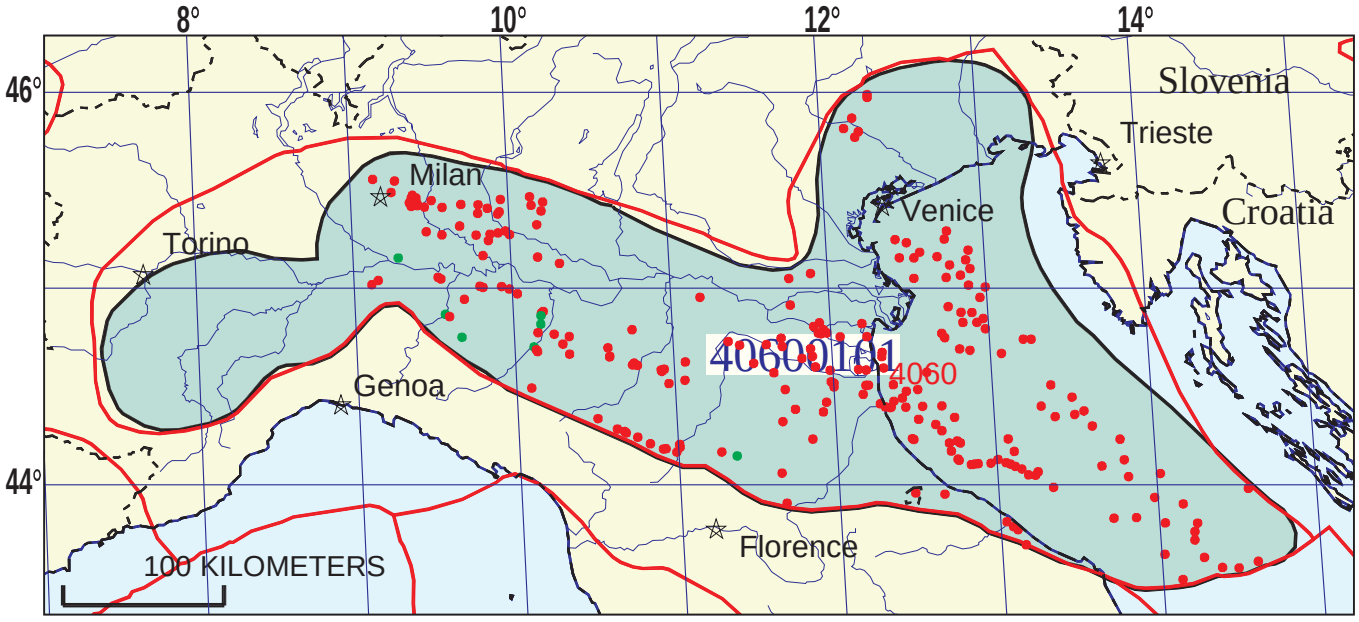
Mattavelli, L., Ricchiuto, T., Grignani, D., and Schoell, M., 1983, Geochemistry and habitat of natural gases in Po basin, northern Italy: American Association of Petroleum Geologists Bulletin, v. 67, no. 12, p. 2239-2254.

Pieri, M., 1992, Cortemaggiore Field–Italy, Po Plain, Northern Apennines, *in* Foster, N.H., and Beaumont, E.A., Treatise of petroleum geology, Atlas of oil and gas fields, structural traps VII: American Association of Petroleum Geologists, p. 99-118.

Pieri, M., and Mattavelli, L., 1986, Geologic framework of Italian petroleum resources: American Association of Petroleum Geologists Bulletin, v. 70, no. 2, p. 103-130.

Riva, A., Salvatori, T., Cavaliere, R., Ricchiuto, T., and Novelli, L., 1986, Origin of oils in Po Basin, northern Italy: Organic Geochemistry (Advances in Organic Geochemistry 1985), v. 10, p. 391-400.

Tissot, B., Mattavelli, L., and Brosse, E., 1990, Trends in organic geochemistry and petroleum exploration in Italy, *in* Huc, A.Y., ed., Deposition of organic facies: American Association of Petroleum Geologists Studies in Geology, no. 30, p. 161-179.



Neogene Flysch Gas
Assessment Unit - 40600101

EXPLANATION

- Hydrography
- Shoreline
- 4060 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 40600101 Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

SEVENTH APPROXIMATION
NEW MILLENNIUM WORLD PETROLEUM ASSESSMENT
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS

Date:……..	8/5/99		
Assessment Geologist:……..	D.L. Gautier		
Region:……..	Europe	Number:	4
Province:……..	Po Basin	Number:	4060
Priority or Boutique……	Priority		
Total Petroleum System:……	Porto Garibaldi	Number:	406001
Assessment Unit:……	Neogene Flysch Gas	Number:	40600101
* Notes from Assessor	MMS growth function.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 1 mmboe grown (≥1mmboe)
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…… Oil: 0 Gas: 177
Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____
Median size (grown) of discovered gas fields (bcfg):
1st 3rd 31 2nd 3rd 58 3rd 3rd 40

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):…….. 1.0

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size…… 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	_____	median no.	_____	max no.	_____
Gas fields:……min. no. (>0)	50	median no.	220	max no.	500

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……min. size	_____	median size	_____	max. size	_____
Gas in gas fields (bcfg):……min. size	6	median size	30	max. size	2000

Assessment Unit (name, no.)
Neogene Flysch Gas, 40600101

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……			
NGL/gas ratio (bngl/mmcfg)……			

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	1	2	4
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……	0.2	0.5	0.8
CO_2 content (%)……	0	0	1
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	100	2300	4500
Depth (m) of water (if applicable)……	0	50	100

Assessment Unit (name, no.)
Neogene Flysch Gas, 40600101

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Italy represents 90 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		95	
Portion of volume % that is offshore (0-100%)……		27	

2. Croatia represents 10 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		5	
Portion of volume % that is offshore (0-100%)……		100	

Neogene Flysch Gas, AU 40600101
Undiscovered Field-Size Distribution