

From Thrust and Fold Belt to Foreland Basins: Hydrocarbon Exploration in Italy*

Anna Cazzola¹, Roberto Fantoni¹, Roberto Franciosi¹, Valter Gatti¹, Manlio Ghielmi¹, and Alfredo Pugliese¹

Search and Discovery Article #10374 (2011)

Posted November 28, 2011

*Adapted from extended abstract prepared in conjunction with poster presentation at AAPG International Conference and Exhibition, Milan, Italy, October 23-26, 2011

¹Eni E&P, Via Emilia 1, 20097 San Donato Milanese (MI), Italy (anna.laura.cazzola@eni.com)

Abstract

The Italian peninsula and its surrounding marine areas underwent a very complex geological evolution due to the superimposition of several tectono-stratigraphic cycles, which, starting from the end of the Paleozoic, modeled the region in several different shapes. The South-Alpine and Apennine thrust/fold belts and their foredeep basins are the results of this evolution. A remarkable tectono-sedimentary variability, at regional and local scales, gives evidence of the complexity of the geological processes involved. In this framework several petroleum systems have developed, some of which are of paramount economic importance (Bertello et al., 2008). These petroleum systems can be associated with three main tectono-stratigraphic systems: biogenic gas in the terrigenous Plio-Quaternary foredeep wedges, thermogenic gas in the thrustured terrigenous Tertiary foredeep wedges, and oil and thermogenic gas in the carbonate Mesozoic succession ([Figure 1](#)).

Biogenic Gas

Biogenic gas has been discovered in the Plio-Quaternary foredeep basins of the Apennines (from north to south: Po Plain, Adriatic Sea, Bradanic Plain and Sicily Channel). Traps are commonly structural. In the inner basin margins they consist of thrustured anticlines ([Figure 2](#)), while in the foreland they are related to draping on the relative highs of the carbonate substratum. Stratigraphic traps are also present, represented by sand terminations along the basin flanks. Nowadays exploration for biogenic gas is mature and is limited to the search for small accumulations near the existing fields.

Thermogenic Gas

Thermogenic gas can be found in the Paleogene foredeep basins of the Southern Alps and of the Apennines, in sediments tectonically involved in the accretionary prisms of the two chains. The exploration of this play is made difficult by the structural complexity of the geologic framework. Traps are usually small and the quality of the reservoirs is sometimes poor.

Oil and Thermogenic Gas

Oil and thermogenic gas have been discovered in the Mesozoic carbonate units in the Po Plain foreland (Villafortuna Field), in the Southern Apennines (Val d'Agri giant Field, [Figure 3](#)) and in Sicily foreland (Gela Field). They are related to three different petroleum systems, associated to the main phases of the Tethyan crustal stretching (Middle Triassic, Late Triassic/Early Jurassic and Early Cretaceous) (Fantoni and Franciosi, 2008).

Results of the Exploration

The results of the exploration history of Italy can be summarized in the cumulative curves of [Figure 4](#). The curve for the gas has a moderate slope until the late fifties, while exploration and discoveries were limited to the northern Apennines and the Po Plain (Caviaga, Cortemaggiore). Then the curve becomes very steep, reflecting a series of successes in the Adriatic Sea (Agostino and Dosso degli Angeli, Barbara), in the Pescara and Bradanica foredeeps (Squalo and Candela respectively), in Calabria (Luna) and Sicily (Gagliano). From the early eighties onward the curve becomes much less steep, indicating that the gas exploration in Italy is mature and activities are mainly conducted near the existing fields.

The cumulative curve for the oil discoveries is remarkably different. After an initial boost with the discoveries in Sicily in the late fifties (Ragusa, Gela), no significant successes were attained until the early seventies when discoveries were made in the deepest carbonate succession of the Po Plain (Malossa) and in the Pescara offshore (Rospo). Two other significant boosts occurred in the eighties (Villafortuna-Trecate, Aquila, Vega) and in the late eighties-early nineties (Val d'Agri, Tempa Rossa). The curve seems to indicate that oil exploration in Italy has probably not reached as a mature stage as the one for gas (Bertello et al., 2010). Some further potential is believed to be left in more complex and deep structural scenarios in the Po Plain and along the Apennine thrust belt.

References

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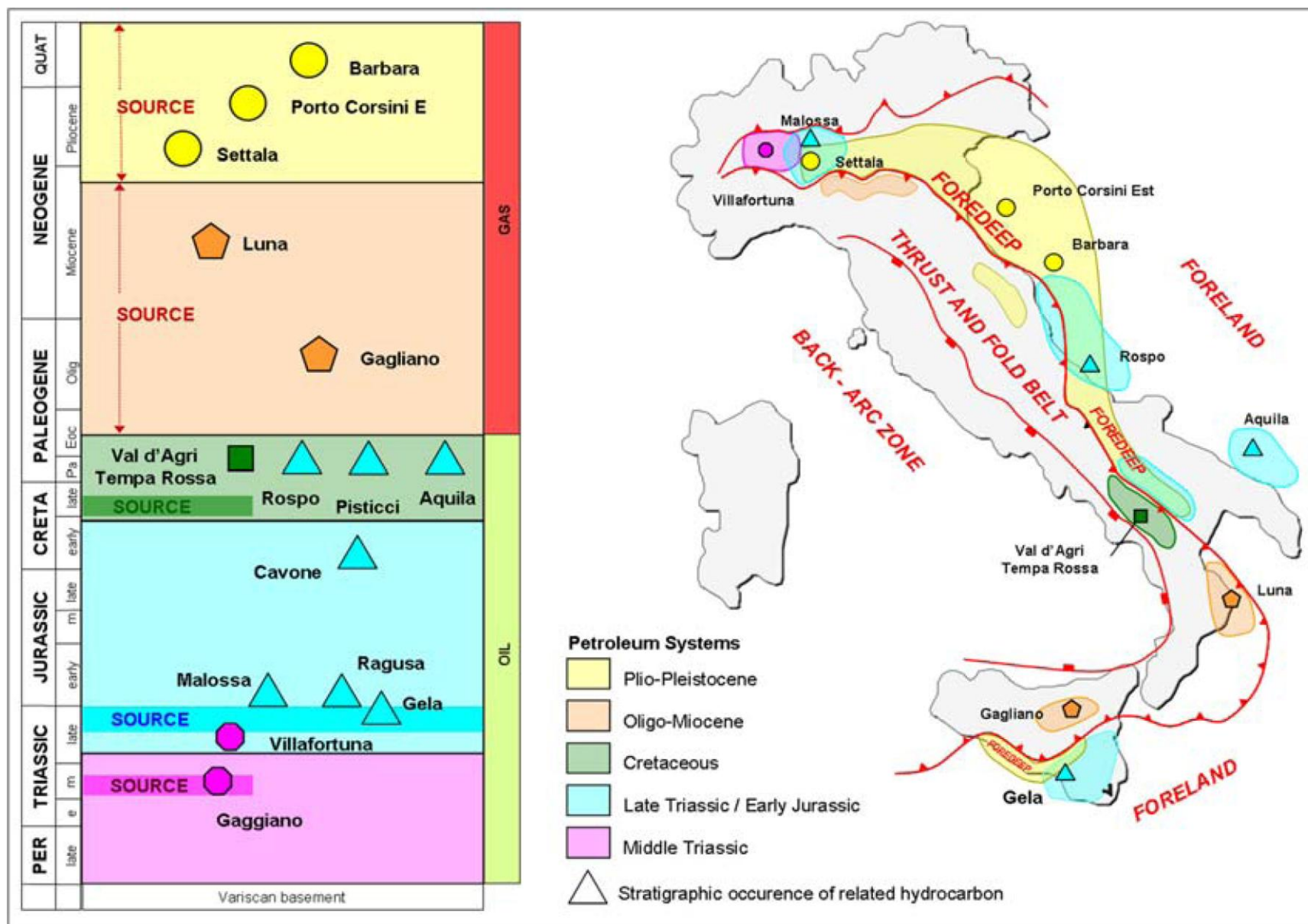


Figure 1. Stratigraphic and geographic locations of the Italian petroleum systems (after Bertello et al., 2010).

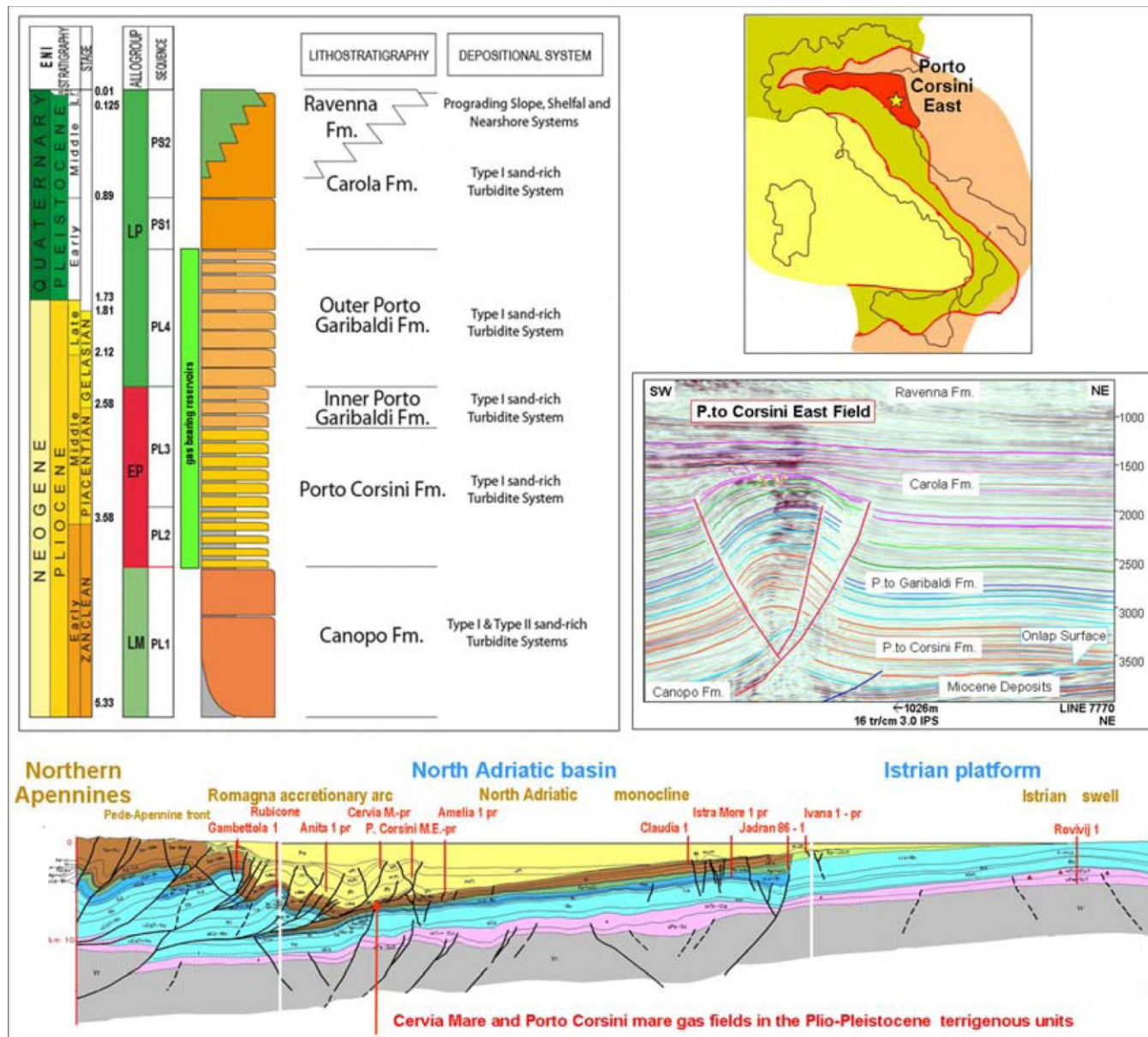


Figure 2. Porto Corsini Mare Gas Field.

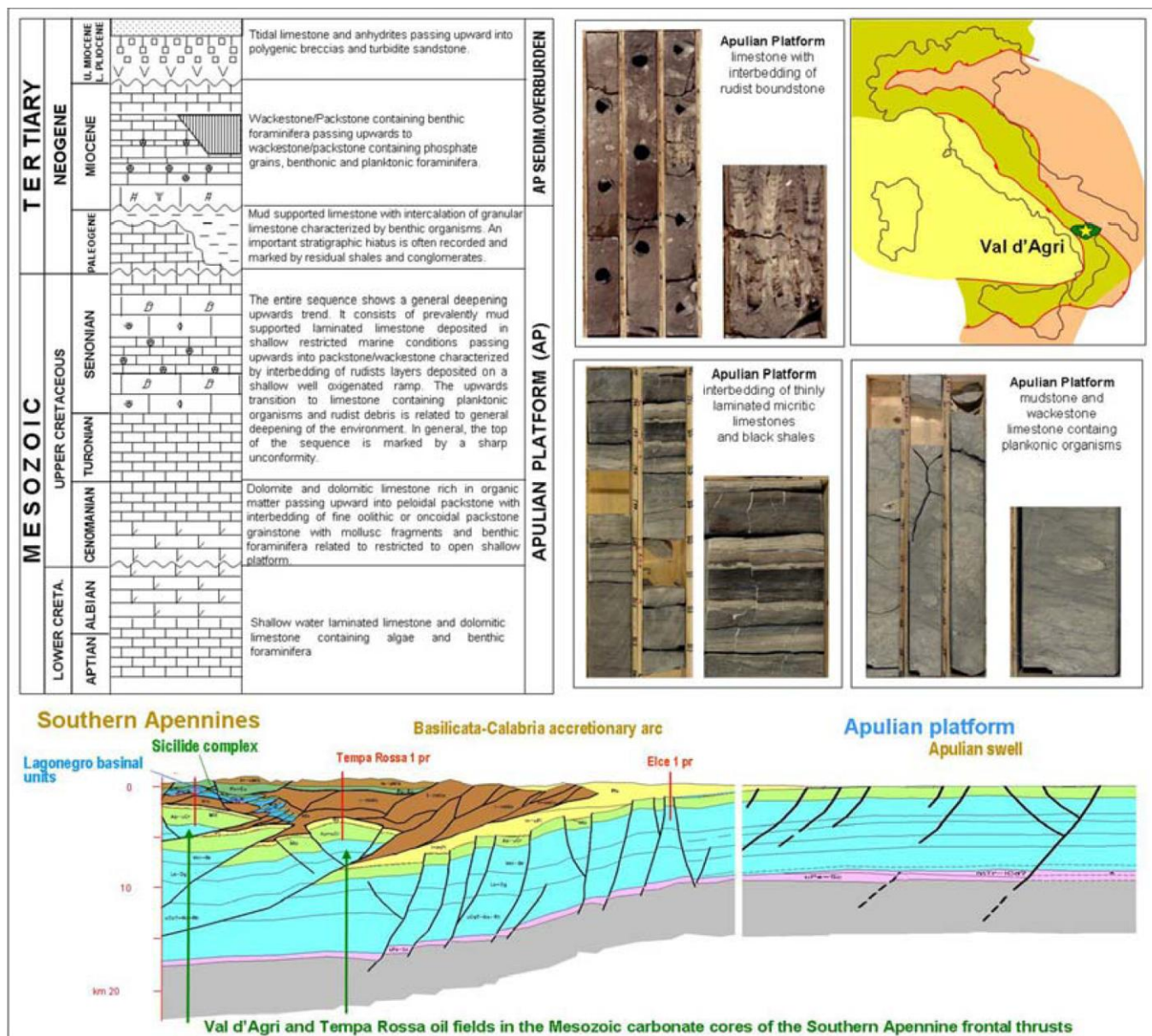


Figure 3. Val d'Agri Oil Field.

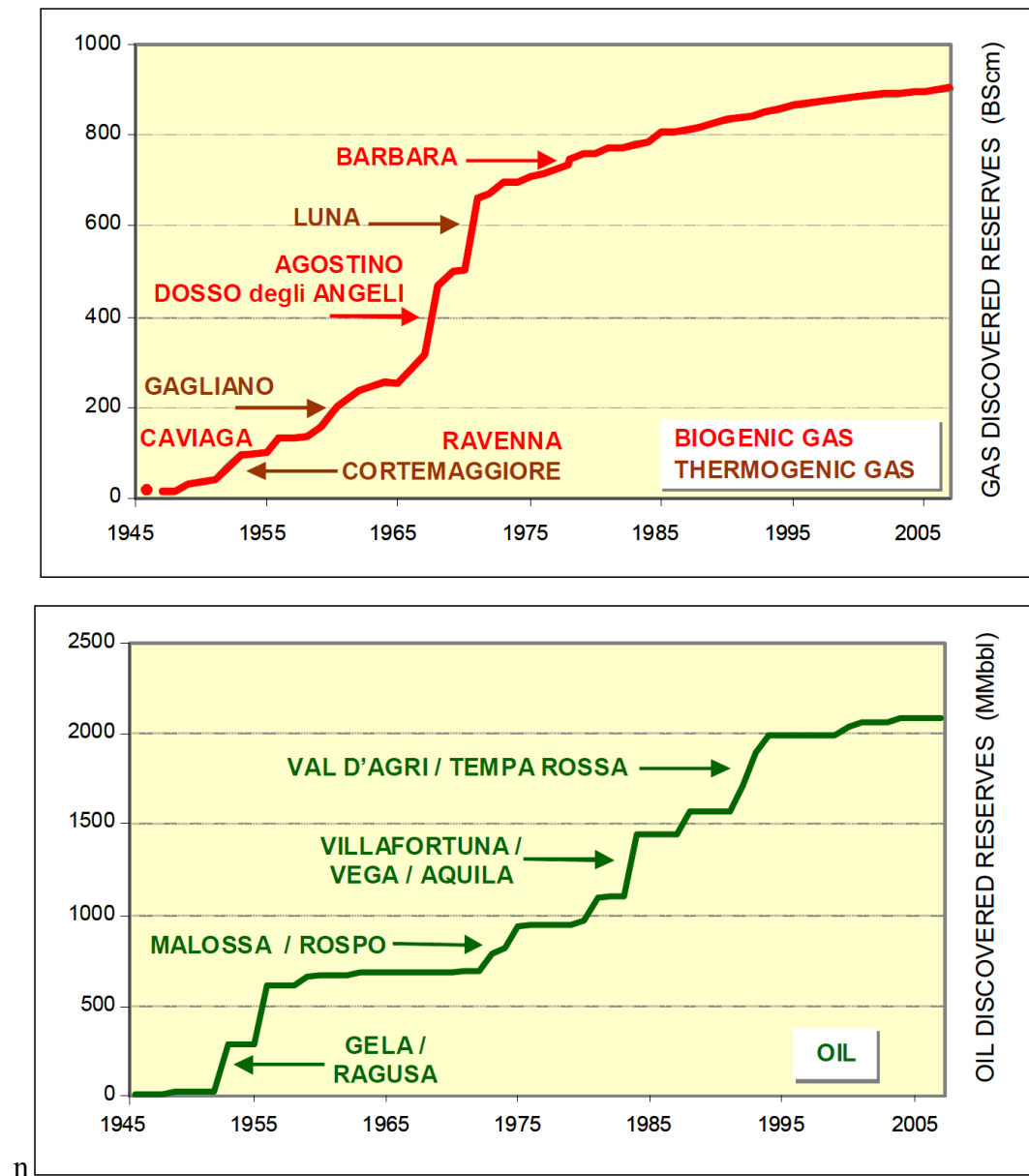


Figure 4. Cumulative discovered reserves (gas in the terrigenous foredeep wedges; oil and thermogenic gas occurrence in the carbonate Mesozoic substratum).