Rooted Structuring as Key for Southern Apennine Oil Exploration

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ABSTRACT

It is Authors' opinion that a key point for the evaluation of the prospect in Southern Apennine, having as target the top of the Apulian Platform, is constituted by the type of the structure involved. That is, if the explored feature is formed by a block rooted with its own basement and practically not or not much displaced, in that case the preservation of the integrity of the reservoir and its oil trapping is possible. But when the explored structure consists of thrust-blocks, disrooted from their basement and prominently displaced, than the resulting reservoir/cover conditions don not allow oil trapping or preservation of oil accumulation. Examples of both types of features are examined.

INTRODUCTION

Almost a decade of international hydrocarbon exploration activity in the Southern Apennine brought to remarkable successes with several producing wildcats and definition of some prominent oilfields (i.e. Monte Alpi-Costa Molina-Mt. Enoc, Cerro Falcone, Caldarosa and Tempa Rossa oilfields).
Common target of every proposed prospect of this thrust belt area was, and rightly remains, the top of the Apulian Platform (AP) below a varying cover, severly deformed and frequently structurally complex. Tops of AP were found by many wells at different depths, in various parts of the explored Southern Apennine area. But the reasons why some features are oil producing and other ones are dry must be cleared up.

STRUCTURAL DISCRIMINATION OF PRODUCING AND DRY FEATURES OF APULIAN PLATFORM

After having collected and examined data in various drill sites, clearly resulted that the pre-orogenic cover of the AP is constituted by Lower Pliocene sequences in the more external features (i.e. Monte Alpi field), or Upper Miocene clastic sediments as conglomerate, or flysch, or breccias in the more internal ones, in agreement with the progressive time-space eastward migration of the orogen. After the first important discoveries, the idea that the top of the AP was the atractive target (at possible depth) for the main part of the Southern Apennine area, became dominant. Consequently, the exploration activity prominently increased, completing the exploration of the major oilfields and progressing in the develpoment of other ones. Moreover the exploration expanded its attention to more internal features like those of Monte Alpi Outcrop axis (Castelsaraceno-1 & Giano Pepe-1 wells) and Rocca Rossa thrust (Rocca Rossa-1). The obtained results (all dry wells) require now an effort of careful understanding to illuminate planning for further investments in this part of the Southern Apennine.
Cases of rooted structures, formed by subvertical or high angle reverse faults and back-faults, with not appreciable horizontal displacements, are those (Fig.1) of the main oil fields of Southern Apennine (i.e. Cerro Falcone, Monte Alpi Field, Caldarosa and Tempa Rossa).
Examples of explored structural highs of AP, consisting of disrooted and more or less prominently diplaced thrust-blocks, are those lying immediately southwest of the above listed oilfields (i.e. Castelsaraceno-1, Castellana-1, Giano Pepe-1 & Rocca Rossa-1).
The Monte Alpi Outcrop axis (Fig.1) is cut, in the north of Giano Pepe-1 well, by an antiapenninic left transcurrent fault affecting the thrusting front and, very probably, responsible for the accomodating east-west trend of Giano Pepe feature.
Small, shallow oil production of Tramutola field, evidently, represents a tectonically dispersed oil accumulation which fits the above expressed distinctive structural considerations.
Stratigraphy of the Monte Alpi Outcrop axis (i.e. Catelsaraceno-1) shows that the thrust process is not delaminating the platform sequence like in the case of blocks of the Apennine (or Internal) platform, but involves the entire thick sedimentary sequence with a shearing plane, very probably located on the basement. As regard to the interpretation of a possible tectonic mechanism displacing the whole Mesozoic sequence (i.e. Castelsaraceno-1 or Monte Alpi Outcrop feature case) it is useful to examine the pre-orogenic geological setting of AP where such conditions are still preserved, or in the Ionian Basin, in the south of the Calabrian Arc.
In Fig.2 a scheme of cross section, reconstructed from seismic data across the undeformed Ionian Sea and its margins, is reported. In the Authors' opinion the Ionian Sea, with its oceanic crust, before the Apennine orogenesis, was extended

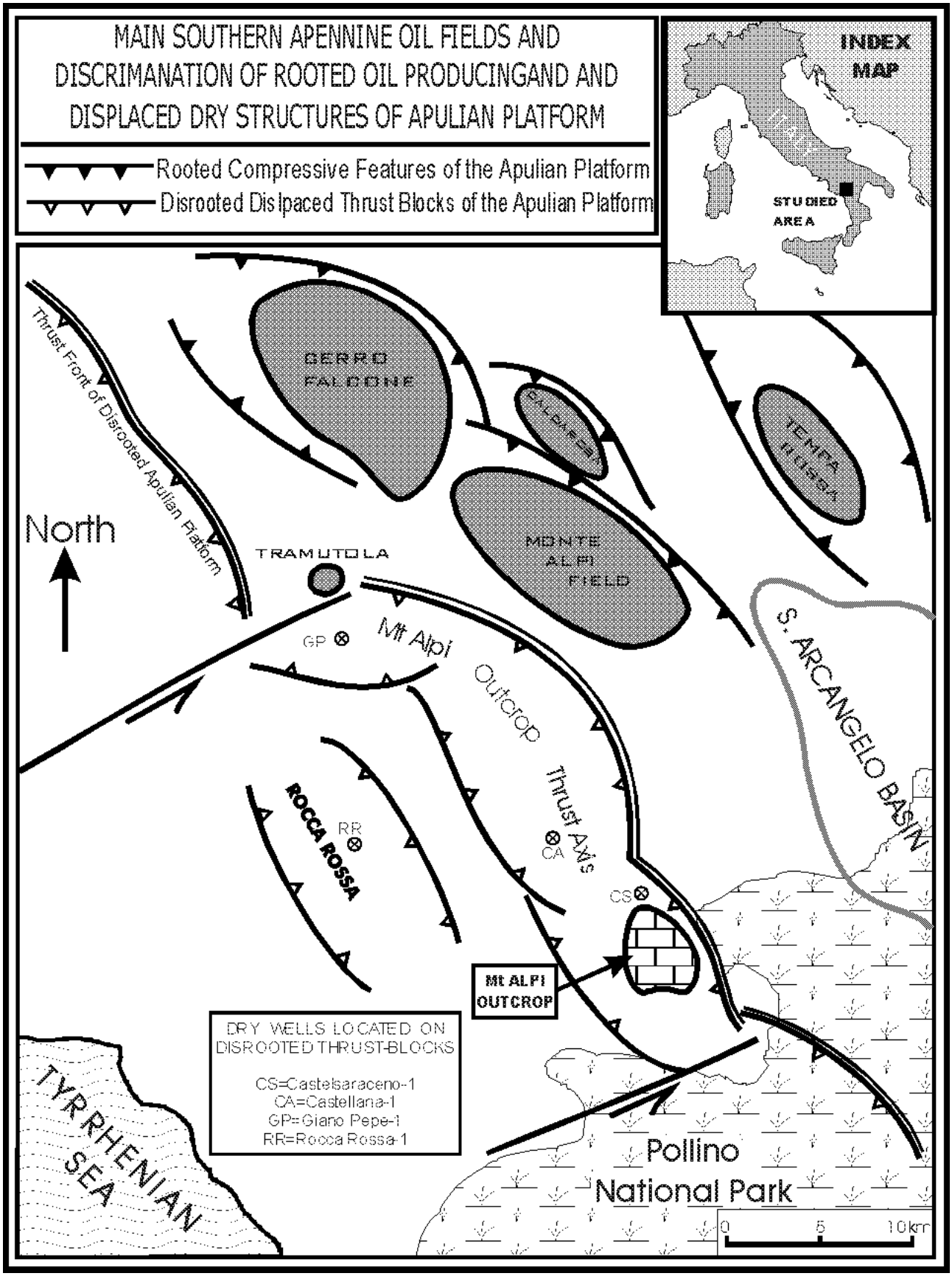

Fig.1 Main oilfields of Southern Apennine area are reported with their schematic compressive rooted features, delimited by subvertical faults and back-faults of the Apulian Platform. In the southwest of the producing AP structures, compressive features which resulted completely dry are indicated. In the Authors' opinion this happens because they are formed by disrooted and displaced thrust blocks.

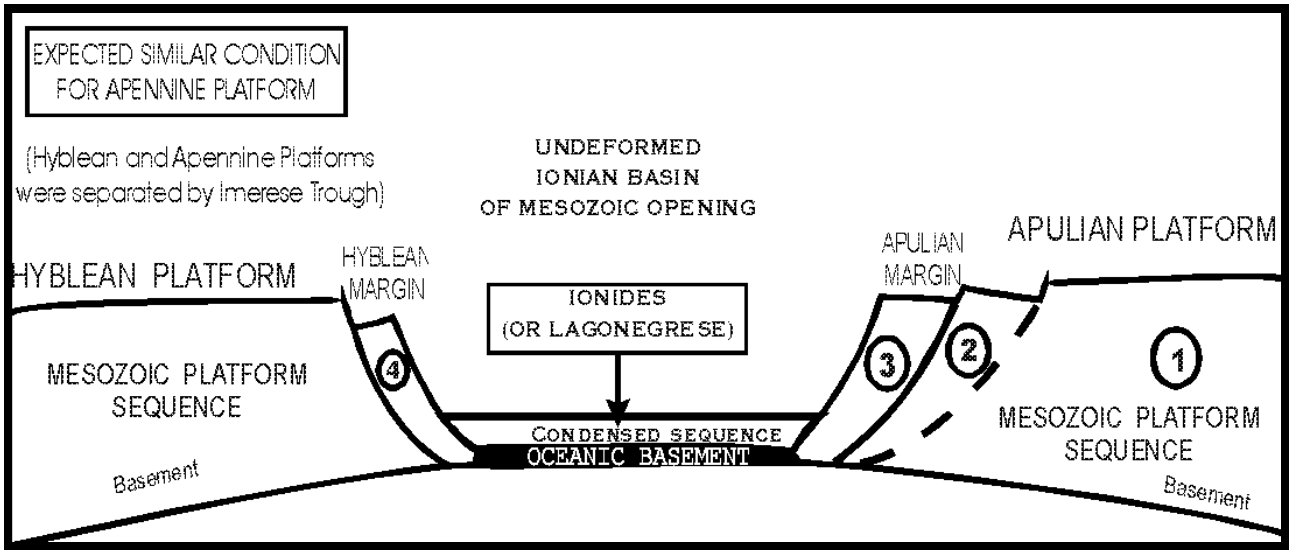

Fig.2 Cross-section scheme (vertically exaggerated) of undeformed Apulian platform and its Ionian slope, reconstructed from seismic data, in the south of the Calabrian Arc. Position of number one in AP is roughly that one of the future rooted compressive oil producing structures. Position 2 and 3 refer to stretched blocks of AP, delimited fy normal faults that during Southern Apennine orogenesis inverted their polarity with displacement far away eastward, forming disrooted dry thrust features.

northwestward (Fig.3) as far as Tethyan or Ligurian-Piedmontese ocean (Finetti et al., 1996), and the thin condensed deep basin sequence, locally known as Lagonegrese, in effect is that one of the Ionian Sea (we name “Ionides”). The AP slope, in the Ionian Sea, is very steep with some marginal stretched blocks (Fig.2).

In our interpretation, as mentioned above, the oil producing area of the Southern Apennine (Basilicata Region) consists of compressive rooted features of the Apulian Platform, more externally positioned than disrooted blocks. We may schematically indicate as zone 1 of Fig.2 the relative position of rooted features. Here, orogenesis produced only structural highs delimited by subvertical reverse faults, where no remarkable horizontal displacement occurred. On the contrary, the more internal explored dry features (i.e. Monte Alpi Outcrop — Castelsaraceno-1 [CS] — Castellana-1 [CA]) axis, Rocca Rossa-1 [RR]) and other more internal wells), should be associated with more or less remarkably displaced thrust-blocks.

Marginal blocks 3 & 2 of the AP (Fig.2), previously stretched during Upper Triassic Ionian opening, still exist on the undeformed ionian margin of AP. Authors’ believe that these blocks and possible others, during Apennine orogenesis, inverting the polarity of their limiting faults, thrust far away some 10÷20 km eastward, on more external positions, moving and duplexing the whole sedimentary pile.

So, discrimination of these two types of AP features, results of critical importance for further successful oil prospecting.

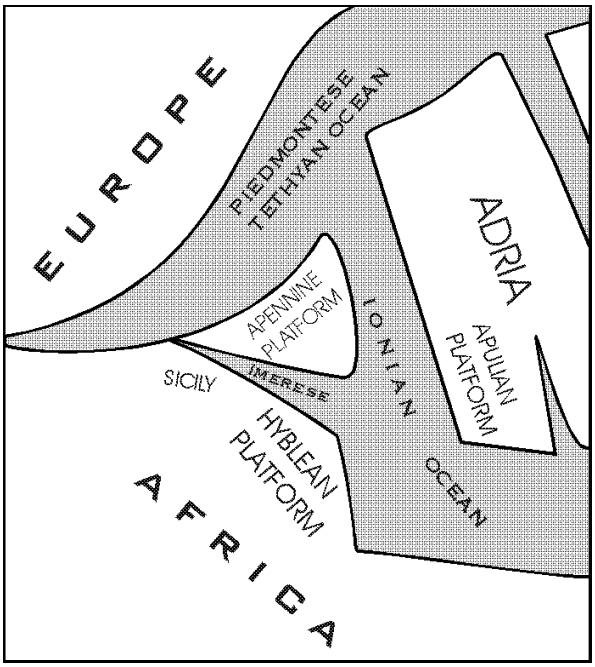

Fig.3 Paleogeographycal setting of the Central Mediterranean in Mesozoic time (Middle Jurassic) before Alpine orogenic phase (Upper Cretaceous-Eocene) with Tethyan closure, and Balearic phase (Upper Oligocene-Lower Miocene), plus Tyrrhenian phase (Tortonian to Present time) with closure of most part of the Ionian Sea and formation of Apennine Chain.

CONCLUSIONS

Examination of oil exploration data of the Southern Apennine area brings to the conclusion that compressive structural

highs of the Apulian Platform constitute the main target of every conducted prospect, but some AP highs result oil producing and some others totally dry.
Present study indicates that the oil producing strutural highs of AP are formed by rooted features, while dry prospects are associated with disrooted and prominently displaced thrust-blocks.

REFERENCES

Finetti I., Lentini F., Carbone S., Catalano S. and Del Ben A., 1996, Il sistema Appennino Meridionale – Arco Calabro – Sicilia nel Mediterraneo Centrale: studio geologico-geofisico; Boll. Soc. Geol. It., 115, 529-559.