

# **PS From Geophysics to Petroleum Systems within Geological Frame of Romania\***

**Elena-Rodica Stoica-Negulescu<sup>1</sup>**

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<sup>1</sup>Oil & Gas University of Ploiesti ([rodica\\_negulescu@hotmail.com](mailto:rodica_negulescu@hotmail.com))

## **Abstract**

Choosing a perfectly adapted to structural-stratigraphic conditions exploration program will reduce geological and economical risk in hydrocarbon discovery. It is a chain of necessary steps in approaching a new area for this objective: Regional structural and stratigraphic study in area of interest; Potential Petroleum Systems definition (main elements, geographic extension); Analysis of existing fields (active reservoirs age and depth); Interpretation of reservoirs distribution laws in area; and Establishing of the best investigation methodology for the next exploration. We will describe these steps in Romanian Petroleum Systems using the most suggestive images and examples for each major hydrocarbon-bearing units. Geological sections at regional scale over Romanian territory, from West to East and from North to South (based also on the geophysical results) will be accompanied by all specific elements of every petroliferous units. An interpretation of active hydrocarbon reservoirs distribution laws will be made in Central-Eastern part of the Romanian Foreland, where thermogenic (Scythian, Carpathian, Moesian) or biogenic (Mio/Pliocene) petroleum systems overlap in their geographic extension.

The detailed examination of the hydrocarbons distribution leads to the conclusion that within certain formations, areas with preferential accumulations and migration pathways are connected with the general configuration of the basin. They are strictly controlled by the tectonic evolution that, in certain cases, caused a redistribution of the hydrocarbons towards higher sectors. A special attention will be dedicated to the key elements and the future targets of Romanian petroleum systems. Geophysical information, especially seismic one was used. The study of the "trace attributes" demonstrating changes in polarity and amplitude, helped us to distinguish the "fluid" and "lithological" effect. "Map Analysis" interpretation results proved the structural evolution and its influence on the faults and their tightness, on depositional environments and trapping mechanisms. We defined in this way the most important areas to be explored in the future and their main characteristics, (expected reservoir age and depth, structural-stratigraphic features). An adequate prospecting methodology can be established in this way. Romania still has a good exploration potential.

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Author: **Stoica-Negulescu Elena-Rodica**,  
P & G University, Romania, [steelro@gmail.com](mailto:steelro@gmail.com)

## Geologic framework and petroleum system elements.

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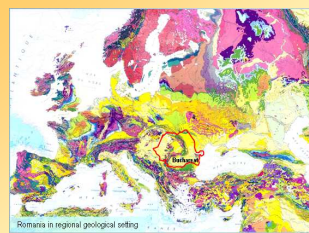
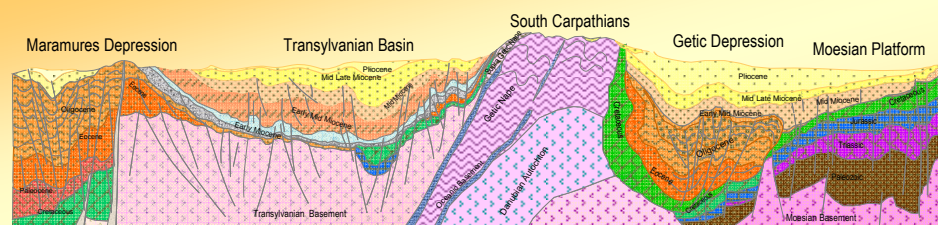
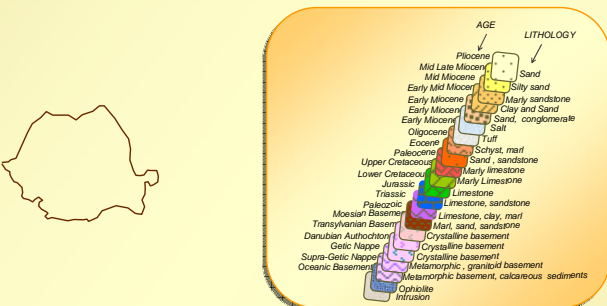
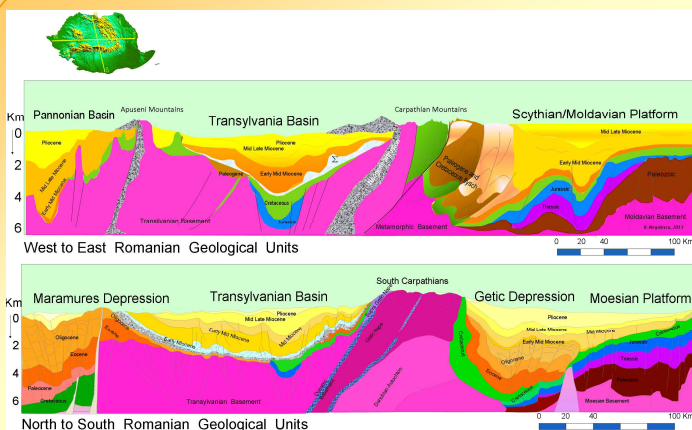
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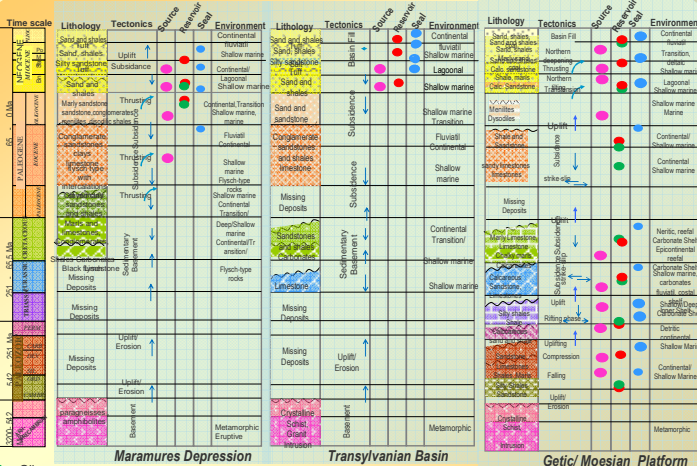
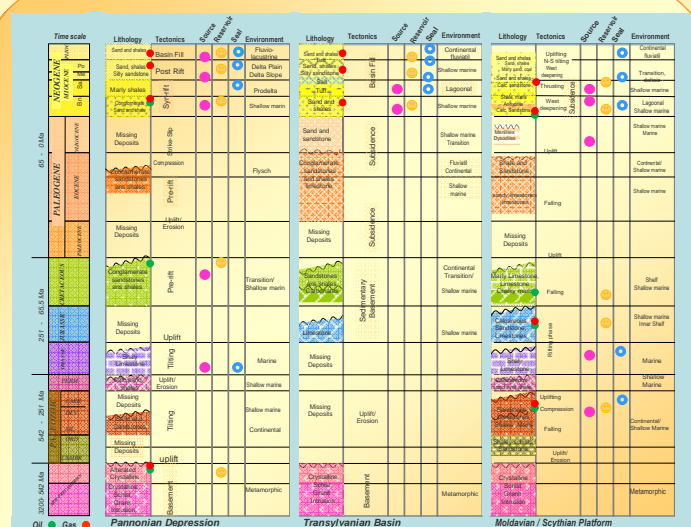
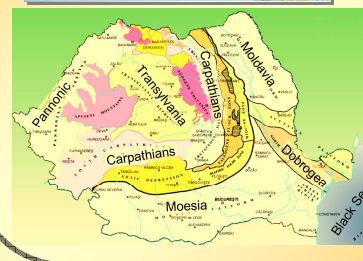


Romanian geological setting in regional context:

-Caledonian orogeny that formed Old Red Sandstone Continent in Early Paleozoic affected the North-Eastern part of Moesia

-The Hercinian orogeny that formed Pangea in Middle Paleozoic formed Dobrogea Orogene

-The Alpine Orogeny in Late Mesozoic-Tertiary when Africa, India plates collided with Eurasia formed Carpathians



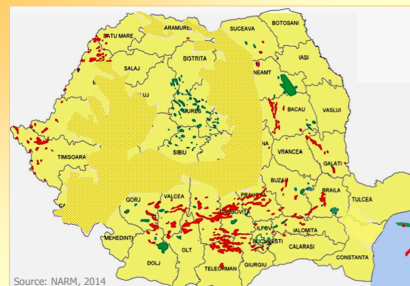


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Author: Stoica-Negulescu Elena-Rodica,  
P & G University, Romania, [stoeneg@pau.ro](mailto:stoeneg@pau.ro)

Distribution of source and reservoir rocks.

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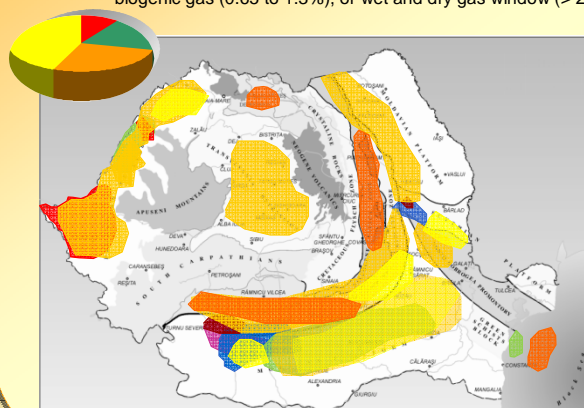


Oil and Gas Fields of Romania

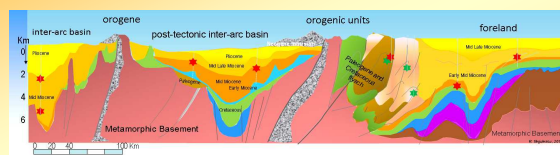
The **source rocks** can be found in all stratigraphic levels from Paleozoic until to Pliocene. Maturity of source rocks varies from basin to basin and from one age to another, being located in the oil window (RV 1.3 -2%), biogenic gas (0.65 to 1.3%), or wet and dry gas window (> 2%).

The **reservoir rocks** are also present in all Romanian sedimentary basins. Neogene and Paleogene formations are ranked first regarding discovered hydrocarbon fields (over 70%). Fields are medium and small size.

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The distribution of reservoir rocks in Romania, according to their age.

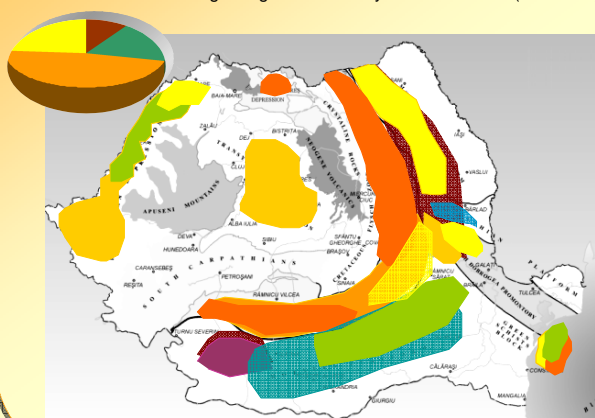


Areas with hydrocarbon fields or source rocks in  
**Basement and Paleozoic** formations.

Areas with hydrocarbon fields or source rocks in Mesozoic  
**-Triassic, Jurassic and Cretaceous** formations.

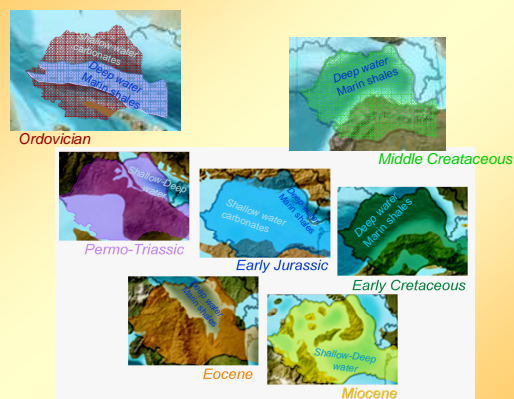
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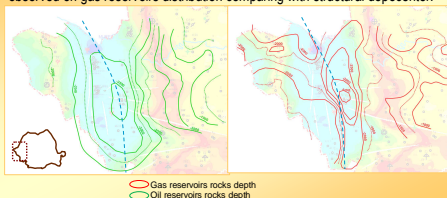
The distribution of source rocks in Romania, according to their age

Source rocks environment in Romanian sedimentary basins.



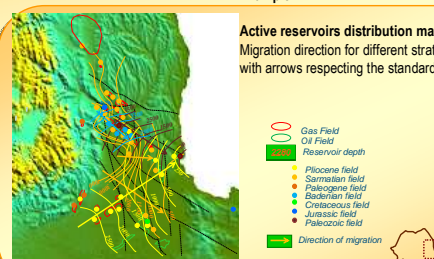
### Example 1

Reservoirs depth distribution map in Southern Pannonian Basin of Romania. For oil, the depth follows up the structural trend. A small eastward shifting can be observed on gas reservoirs distribution comparing with structural depocenter.



### Example 2

Active reservoirs distribution map in East-Central Romania. Migration direction for different stratigraphic level are represented with arrows respecting the standard colour of the geological age.



Interpretation of active hydrocarbon reservoir distribution and migration trends



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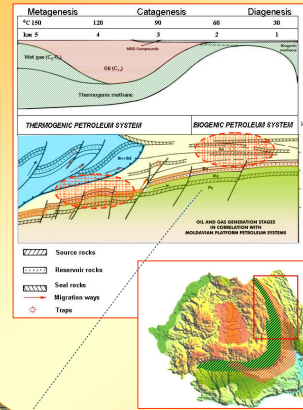
Author: Stoica-Negulescu Elena-Rodica,  
P & G University, Romania, stoicael@pau.ro

Characteristics and targets of major Petroleum Systems.

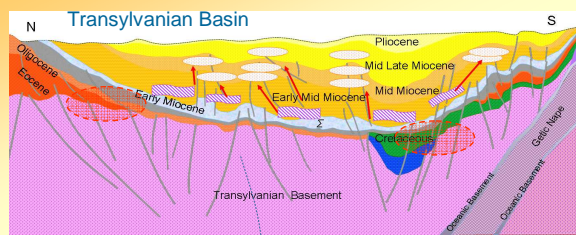
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The major structural units with hydrocarbon potential correspond to the orogenic type basins (Transylvanian, Pannonian basins, the Flysch and the Molasse of Carpathians), or to the foreland type basins (Moldavian Platform, Moesian Platform, Black Sea Continental Shelf).

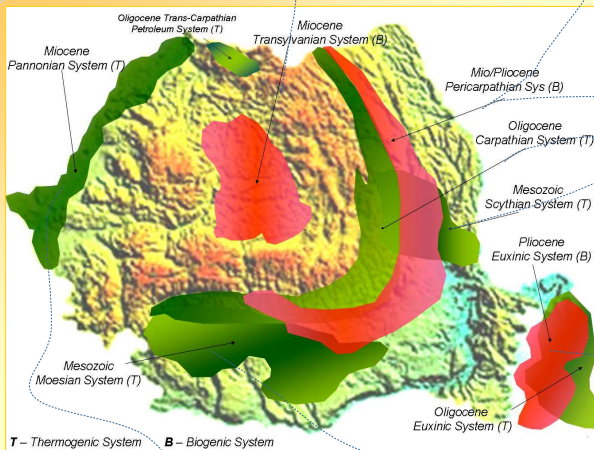
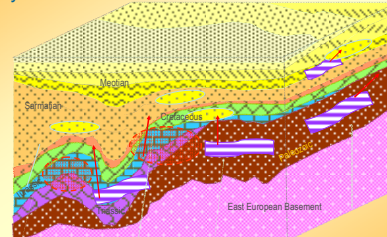
Taking into account the geographic, stratigraphic and temporal criteria, in correlation with geochemical studies we can talk about thermogenic petroleum systems (Carpathian, Pannonian, Moesian.), or biogenic ones (Transylvanian, Precarpathian, Euxinic).



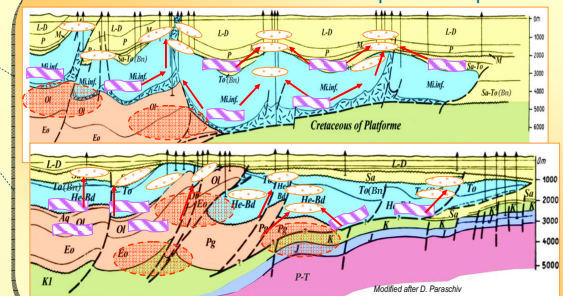
Moldavian Platform



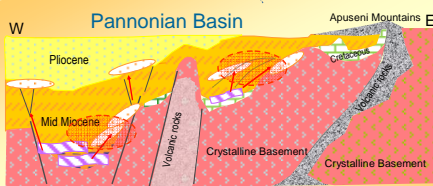
Scythian Platform



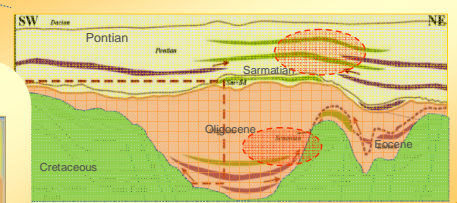
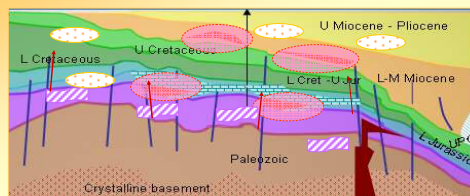
Pericarpian Depression



Black Sea Basin



Moesian Platform



**Future Targets**

## Conclusion

Analysis of the geological context of the petroleum systems development enable a better assessment of hydrocarbon potential. Romanian sedimentary basins have still areas with new oil and gas resources entrapped in all kind of traps, especially subtle ones: -structural up-lifts, faulted anticlines, strike-slip structures, reef or diagenetic structures in Paleozoic, Triassic, Jurassic, Cretaceous, Paleogene formations of the thermogenic systems; -erosional or diagenetic structures, compacting anticlines, paleo-deltaic systems in Miocene-Pliocene formations of the thermogenic systems; -diapiric structures, truncations, pinch-out in paleo-deltaic systems, turbidites, channel structures in Miocene-Pliocene formations of the biogenic systems.

Analysis of geophysical and wells data in conjunction with information from the literature indicates that Oligocene - Lower Miocene source rocks played the most important role in thermogenic hydrocarbons bearing. The biogenic gas is sourced from deep marine and deltaic Middle Miocene shales. The unconventional shale gas potential of Silurian, Lower Devonian and Middle Jurassic must be more investigated. The "basin-center tight gas" that is currently explored in the Pannonian basin most likely extends into Romania as well.

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