

The petroleum systems the lusitanian basin



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The tectonic and sedimentary evolution of the basin and its paleoenvironments created the different petroleum systems known in the Lusitanian basin. The source rocks, the reservoirs, the maturation phases, the traps and its processes show direct relations to the Mesozoic and Cenozoic evolution in Lusitanian basin.

Significant amounts of petroleum were probably generated in the Lusitanian basin as evidenced by the numerous surface manifestations (oil seeps) and well shows. Several exploration wells have been drilled around the Montejunto anticline, mainly in the Late Jurassic depocentric sub-basins of Bombarral and Arruda, where the source rocks migration paths and thicker reservoirs are located. Most of them had oilshows, but with no commercial viability.

It is known that there are Paleozoic rocks with capacity to generate hydrocarbons reaching the gas window. The values of TOC and vitrinite reflectance are relevant and confirm this generation capacity.

The Lower Jurassic of Lusitanian basin saw a marine invasion which presented very good contents in organic matter, e. g. Coimbra Formation. However, according to Pimentel et al, 2010, there were favorable maturation conditions to reach the oil window due to the insufficient subsidence after the first rifting episode. However there were, afterwards the second rifting episode (Upper Jurassic), enough conditions to mature the organic matter. In Callovian there was a transgressive episode that installed on the eroded surface of the Middle Jurassic formations. That was a shallow marine

environment with hypoxic conditions which means that there were big accumulations of organic matter, mostly of algal origin.

According to Alves et al, 2003 the salt bodies were responsible for the differences in thickness, specially of Cabaços Formation, however the peak of the maximum subsidence of the Upper Jurassic source rocks are located in the study area of this work, in the Central sector as well for the TOC and vitrinite reflectance values of Cabaços Formation that present the highest results for the entire basin.

The hydrocarbons in the Lusitanian basin are present in sandstones of different environments and ages as in porous and fractures carbonates from Jurassic and Cretaceous.

In Dagorda Formation there are dolomitic levels with primary porosity until 20% and in Cabaços Formation there is significant intercrystalline porosity. In the Middle Jurassic, the Candeeiros Formation can represent a good reservoir because of the presence of the shallow environments limestones. In the Upper Jurassic the limestones of Montejunto Formation can also contain porous fractured reservoir enhanced by its stratigraphic and geometric proximity to the Upper Jurassic source-rock Cabaços Formation.

Regarding the siliciclastic reservoirs, the Lusitanian basin is rich in siliciclastic deposits related to the tectonic events, erosion and deposition. One of the best examples is the Grés de Silves Formation from Upper Triassic with average porosities between 16% and 23%.

The mudstones from Dagorda Formation are the main seal in Lusitanian basin. These mudstones with evaporitic levels are associated to the diapirism and trap development. Its plasticity gives to Dagorda Formation the ability to move to stratigraphic levels of Jurassic and Cretaceous ages which can work also as a seal in hydrocarbon accumulations.

Regarding to the upper formations, Pena dos Reis and Pimentel (2010), believe that these are not effective seals due to the existence of sand levels. However it is said that Brenha and Candeeiros Formations can work as seals thanks to the limestones and marls of this group.

In Lusitanian basin can be identified some stratigraphical and structural traps. The best and most evident example of a stratigraphical trap is the Grupo de Silves (reservoir)-Dagorda Formation (seal), able to accumulate hydrocarbons from lower levels (Paleozoic) and from upper levels (Jurassic).