Mesozoic tectono-stratigraphic evolution of the Northwestern Sirte basin (Gulf of Sirte, offshore Libya)

Martina Bruno1, Lorenzo Trupiano1, Paolo D’Adda1, Paolo Carubelli1, Giuseppe Serafini1.

1Eni Spa. San Donato Milanese (MI), Italy

Abstract

OBJECTIVE/SCOPE
The Gulf of Sirte, offshore Northern Libya, is an underexplored hydrocarbon province of the Mediterranean area. In this work, the Mesozoic tectono-stratigraphic relationships have been analyzed by means of detailed 2D seismic interpretation and well data to reconstruct a basin-scale evolutionary model.

METHODS, PROCEDURES, PROCESS
The fault network and the main seismic horizons have been interpreted on the 2D seismic time data set then calibrated with well information. Isochrone maps have been produced to identify and evaluate the depocenter distribution within the study area and through time. A further precise calibration of the interpreted faults and depocenters has been performed. By integrating all this information, Gross Depositional Environment maps have been built along with the structural evolution of the basin.

RESULTS, OBSERVATIONS, CONCLUSIONS
The Sirte sedimentary basin is part of the SE Mediterranean margin and is involved in the evolution of southern Neotethys. It is characterized by WNW-ESE to NNW-SSE trended regional main normal faults, although secondary NE-SW faults have been also recognized. The basin architecture is articulated by asymmetric horst and graben structures segmenting the depocentral area. The en-echelon pattern of the main faults suggests a possible right-lateral transtensional regime, marked by synsedimentary activity from Late Paleozoic to Turonian. Partial inversion along major faults occurred during Upper Cretaceous to Tertiary, as testified by localized folding of Santonian to Maastrichtian strata.

The regional depositional trend is overall transgressive: Triassic continental and shallow marine siliciclastic depositional systems are followed upward by Jurassic shallow marine carbonates, in turn drowned during a Cretaceous deepening episode which also records the backstepping of the clastic systems. The Cyrenaica high is characterized by active transtentional tectonics from Triassic, followed by minor activity from Jurassic to Late Cretaceous, leading to carbonate platforms nucleation and stable evolution. In contrast, due to local tectonic activity, the Sirte margin is affected by a faster relative sea level rise, causing a more rapid deactivation of clastic systems and their replacement with carbonate ones.

NOVEL/ADDITIVE INFORMATION
The integrated study has improved the knowledge of the Mesozoic basin evolution and the regional distribution of the depositional systems. This is of the uppermost importance when it comes to predicting the prospectivity of frontier areas.

Keywords: Sirte Basin, Libya, Structural model, Sedimentological model, Platforms, Deep water siliciclastic systems