AAPG European Region Annual Conference
Paris-Malmaison, France
23-24 November 2009

TECTONO-SEDIMENTARY EVOLUTION of the TERTIARY SEQUENCES along the OUTER FRONT of the NORTHERN CALABRIAN BELT (ITALY): EXPOSED RESERVOIR ANALOGUES of the OFF-SORE GAS FIELDS

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Since the seventies, Hydrocarbon exploration focused in the Ionian side of northern Calabria, resulting in some discoveries of gas fields of economic interest.
The shallow-water to on-shore Luna and Hera Lacinia fields started to be developed in 1975, producing dry gas (methane 99%) with an average productivity of about a $1.2x10^9$ Sm^3/year.
Luna field, a Tortonian thrust-related anticline, produces from two different Miocene clastic sequences. The source rock in the area is not well defined, and the seal is given by Late Miocene or Plio-Quaternary sediments in different sectors of the field.

Sediments, which reservoir gas off-shore, are widely exposed along the Calabrian on shore and exhibit a complex deformation.
The tectono-sedimentary evolution of these Tertiary successions cropping out along the north-eastern calabrian margin was investigated, describing timing, geometry and kinematics of their structures.

Middle Miocene deposits accumulated in a common wedge-top depozone of the calabrian foreland-basin system, filled three distinctive depocentres: the Rossano, Cirò and Crotone basins.
As such, this succession, overlying both crystalline and sedimentary bedrock units, includes alluvial fan, near-shore and shallow-water sediments, overlain by fine-grained turbidites and evaporites.
During Late Tortonian-Early Messinian, huge volumes of Sicilide-derived rocks composed of variegated clay matrix and large blocks (olistholiths) of limestone and sandstones have been emplaced. The latter bodies can be related with the accommodation due to out-of-sequence thrusts, or with back-thrusts of the Sicilide units.
The post Messinian emplacement of the so-called “Cariati Nappe” (CN) in the central sector of the study area interrupts the lateral continuity and affects the sedimentary supply of as such configured foreland basin.The CN includes a Middle to Upper Miocene clastic succession unconformably covering an Eocene-Oligocene siliciclastic flysch. It shows two thinning and fining-upward units made of conglomerates and sandstones showing braided fluvial and deltaic facies associations, evolving to prodelta turbiditic bodies.
The asymmetry of the CN, bordered to the west by strike-slip and transpressive faults, is testified also by not coaxial folding. The growth of NW-SE and N-S fold trends is responsible of progressive unconformities observed.
Structural data show that the CN is a transpressive structure formed along restraining bends of the NW-SE striking, left-lateral, Rossano-S.Nicola Fault Zone. In particular, this structure represents the distal part of the Serravallian-Tortonian basin infill, together with its Eo-Oligocene bedrock, back-thrusted onto its margin.

Along the outer front of the northern Calabria, strike-slip fault zones, which play also an important role at the regional scale, produced regional wrenching of the Miocene basins and controlled the development of intrabasinal structural highs (like the CN) bordered by back-thrusts and producing tectonic inversion in some sectors.
This is testified by facies association and petrographic data recording strong erosion and "cannibalization" processes of the lower stratigraphic units, while in some areas (i.e. in the Cirò basin) persisted marine clastic sedimentation.

Since the CN can be considered as exposed analogue of the off-shore structural highs, it is pointed out that at the scale of the whole basin, major compressional structures are time-dependent, as they are Tortonian in age within the Crotone basin (see Luna Field), and they likely date Latest Miocene within the Ciro' basin. These compressive features can be connected with a common strike-slip tectonic regime affecting the entire Ionian border of the northern Calabria.