Outcrop/Behind Outcrop Characterization in Onshore Western Mediterranean Basins of Southern Iberia*

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Search and Discovery Article #41175 (2013)**
Posted August 19, 2013

*Adapted from oral presentation given at AAPG European Regional Conference & Exhibition, Barcelona, Spain, April 8-10, 2013
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Abstract

The recent geologic evolution of the southern Iberian Peninsula has resulted in spectacular Mesozoic and Cenozoic outcropping formations whose study has been crucial on unraveling the evolution of the western Mediterranean region.

Its preliminary outcrop/behind outcrop characterization is valuing these well-studied outcrops as oil and gas clastic reservoir analogs in a basin margin setting. This has been allowed by the recent PTR Unit foundation in the Scientific Instrumentation Center at the University of Granada, including drilling equipment, a set of probes for geophysical well logging and a core scanner. Borehole logs obtained include Natural and Spectral Gamma Ray (QL40-GAM, QL40-SGR), as well as Optical and Acoustic Televiewers (QL40-OBI, QL40-ABI). Architectural and facies analysis of the outcrop as well as petrological and petrophysical characterization of potential reservoir and seal rocks complete this study.

Financial support was provided by Research Project CGL2009-07830 and Research Group RNM369 of the Junta de Andalucía. We also thank the facilities offered by the municipalities of Alcaraz, Villarrodrigo and Bienervida and by the landowner Mr. Luis Fernandez. The Consejería de Agricultura of the Junta de Castilla-La Mancha granted the appropriate permissions for the development of this research.

Selected Reference

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www.sedregroup.com
SEDREGROUP

• Sedimentary Reservoirs Workgroup
• Field courses on outcropping analogs
• Stratigraphic, sedimentologic, petrologic and petrophysics perspective
• http://www.sedregroup.com/

Component members:

University of Granada (UGR)
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Prof. Juan Fernández: Professor of Stratigraphy, clastic sedimentologist
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Delft University of Technology
Dr. Marinus E. Donselaar: Assoc Prof, clastic sedimentologist

University of Calabria
Dr. Luca Caracciolo: Postdoctoral assistant, clastic petrologist

Team Expertise

Stratigraphic Architecture of Detrital Formations
Sandstone Sedimentology and Petrology
Carbonate Sedimentology and Petrology
Claystone and Soil Micromorphology
Reservoir Modelling
Geometrical and facies analysis of sedimentary bodies as outcrop analogs for hydrocarbons reservoirs and aquifers
Triassic and Neogene examples from south Iberia

Current Project (MICINN)

Observer Promoting Entities (E.P.O.)

SEDREGROUP
Unknowns

- Dry wells between productive wells?
- Differential impregnation in the same bed?
- Different stratigraphy in contiguous wells?
- Low yields in rocks of positive petrophysics?
- Volume of oil crude lost in undrilled discontinuous beds?
- Suitability of directional/deviated drilling?
- Desirability of stimulating the production?
- Modeling of a highly heterogeneous reservoir?

Answers from the sedimentology

- Post depositional history (diagenesis, tectonics)
- Original heterogeneity (geometry, lithofacies)

outcrop analogs for the TAGI: TIBEM, THATLAS
Trias of the tabular cover of the Iberian Meseta

TIBEM (Spain)

Trias de l’Haut Atlas

THATLAS (Morocco)

TAGI (Algeria)

Trias Argillo Gresseux Inférieur
Research techniques \textit{(macro and mesoscale)}

Facies Analysis

Architectural Elements Analysis
Research techniques (microscale)

- X-ray diffraction, Ultrasounds, Porosimetry, Permeability
Drilling equipment

Drill core scanner

Set of probes:
- Optical Televiwer (QL40-OBI)
- Acoustic Televiwer (QL40-ABI)
- Gamma Ray Natural sonde (QL40-GAM)
- Spectral Gamma sonde (QL40-SGR)

New equipment (PTR unit, Scientific Instrumentary Center, UGR)
Current challenge: behind-outcrop drilling

Drilling cores
Well logging
Well logging in the TIBEM
(after Henares et al., 2013, modified)
Comparative architectures between K2 unit (TIBEM) and T6 member (THATLAS)

After Viseras and Fernández, 2010
Comparative architectures between Seq II (TIBEM) and Ourika Valley sandstones (THATLAS)

After Viseras et al. 2012
Implications for exploration geology

(High sinuosity channels)

1.- High petrophysical heterogeneity
2.- Channel deposits: most porous facies
3.- Clay beds - lateral baffles to fluid movement

Effective porosity: 29.66%
Interesting reservoir characteristics (braidplain sandstones)

1. Thick layer of kilometric lateral continuity
2. High porosity, no lateral/vertical baffles
3. Accurate reserves estimation
4. Extrapolation of the discovery throughout km²

Effective porosity: 31.7%
TIBEM, THATLAS: outcrop analogs for the TAGI

- Fluid movement
- Enhanced Oil Recovery
- Modelling
- Production strategies
Thank you