

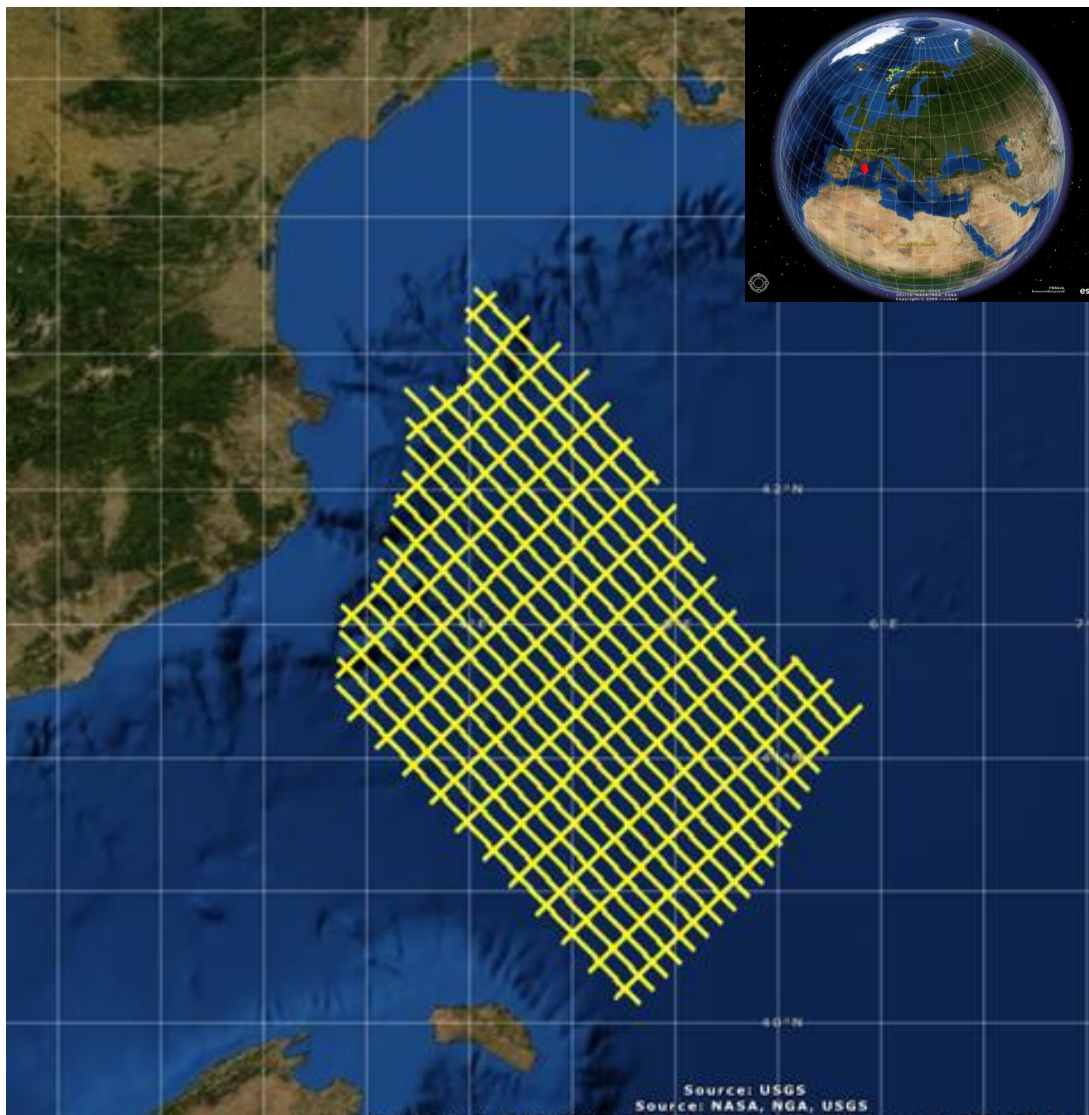
*Extended Abstract: Poster presented at the AAPG European Regional Conference and Exhibition, 13-15 May 2014, Barcelona: New Developments in the Investigation of Conventional and Unconventional Petroleum Systems in European Basins*

## **The West Mediterranean Salt Basin – Prospects and Plays in and around the North Balearic Basin, Offshore Spain.**

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This paper looks at hydrocarbon potential in and around the North Balearic Basin, offshore Spain.



*Fig 1: Location of proposed Multi-Client seismic survey – North Balearic Basin, Spain*

The Basin is part of the ‘West Mediterranean Salt Basin’ (Roberts & Christoffersen, 2013). The salt is of Messinian age and is typically over 1000m thick and seen to exhibit classic extension (salt welding and rollover anticlines), translation (salt pillows) and contraction (salt diapirs). Its nature is the key to the post salt plays which can be seen (many with DHI’s).

As well as evidence for a biogenic post-salt gas system, there is evidence (from satellite seep studies and seismic data) pointing to an active thermogenic (presumably) oil generating province.

The presentation is based on work carried out by the authors and their colleagues in the planning of a new long offset multi-client seismic survey in the North Balearic Basin (fig 1). For this, vintage seismic data was obtained (fig 2) and reprocessing and selective depth conversion carried out; together with petroleum system modelling (including ties with the proven Gulf of Valencia petroleum system).

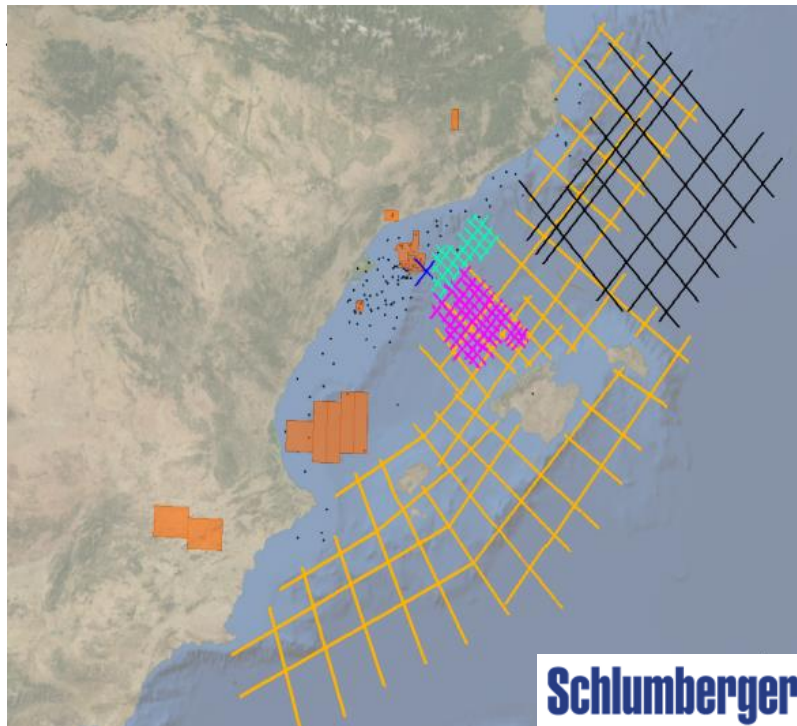


Figure 2: Vintage data from Western Geco and others – used for study

In the study area three petroleum systems have been recognised:

- A) Pliocene/Quaternary - biogenic source:  
Post Rift/Post Salt plays: deltaics, turbidites and channel sands in structural and stratigraphic traps.
- B) Pre Messinian (Oligocene/Miocene) - sourced from Oligocene/Miocene sapropels (ie organic rich muds - Pawlewicz 2004) and shales.  
Post Rift/Pre Salt plays: deltaic/ turbidites sealed by Miocene shales and Messinian salt.  
Syn Rift: canyon sands and deltaics.
- C) Pre Tertiary: on the margins of the Basin.  
Pre-Rift plays: possible basement plays as seen in the Casablanca field area – sourced from overlying Oligocene shales or from the Mesozoic (as in the Amposta field).

Petroleum system modelling was conducted for a 2D composite section in the Valencia Trough/North Balearic Basin, with the key objective of evaluating the hydrocarbon prospectivity in the deeper part of the basin. Closer to the shoreline discoveries such as the Amposta and Casablanca oil fields prove the existence of at least two petroleum systems with the Jurassic Ascla and Miocene Alcanar formation being the most important source rocks (fig 3).

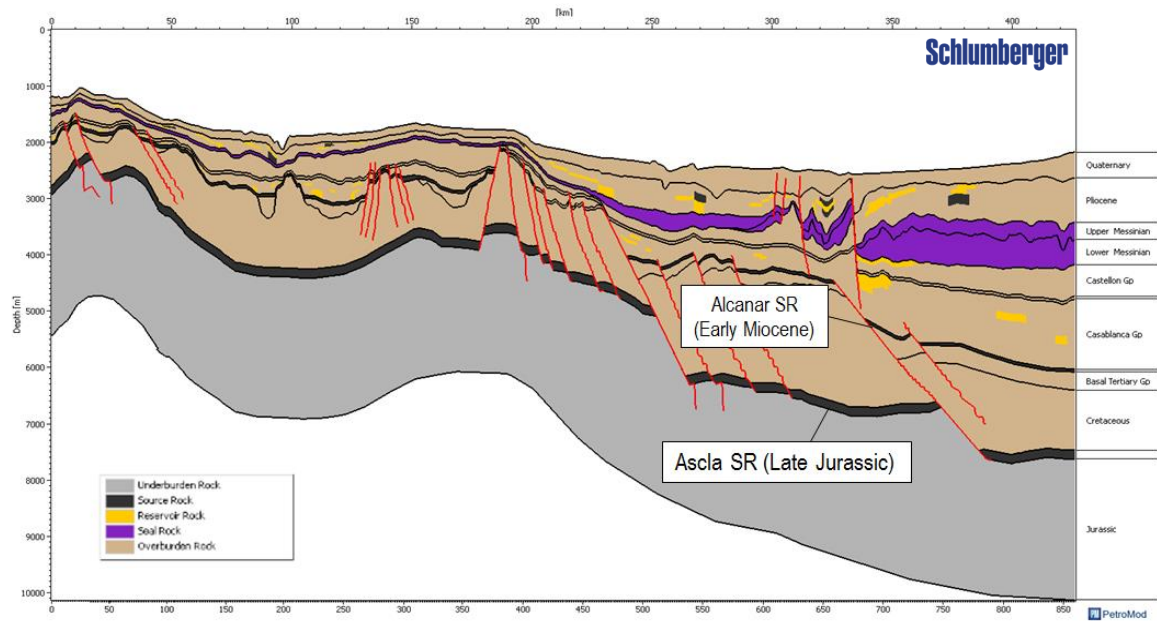


Fig 3: Petroleum System Elements – Modelled line

The modelling was constrained by work done, as reported by Shtukert et al (2014), on the Ibiza Marino AN-1 well (Fernandez et al. 1990) and the Amposta field (Seemann et al, 1990) where the results are in agreement with those in the literature (Rossi et al, 2001; Playa et al, 2010) indicating that significant Neogene subsidence triggered late hydrocarbon generation of the Jurassic Ascla source rock - charging Cretaceous karstified carbonates. Hydrocarbons generated from Miocene Alcanar source rock contributed to this accumulation via downward expulsion.

Modelling results showed:

- 1) Hydrocarbons were significantly generated during periods of major subsidence: Late Mesozoic and Neogene. The Jurassic Ascla source rock started to generate hydrocarbons during Cretaceous with a high risk of losses due to lack of seal and Paleogene erosion (as in the onshore Maestrat basin). However, significant Neogene burial can result in late-stage generation. Favorable play types are Cretaceous karstified carbonates and carbonate buildups, both sealed by Neogene, compacted mudstones.
- 2) The Miocene Alcanar source rock started to generate hydrocarbons in Neogene depocenters. Favorable plays are Miocene reservoir rocks sealed by Messinian (salt in the Gulf of Lions area, and Upper Evaporites further to the south) or Miocene turbidite sandstones of the Casablanca Group sealed by mudstones of the Castellon Group.

Hydrocarbon plays are numerous and exist in the Pre-Rift, Syn Rift, Post Rift/Pre Salt and Post Rift/Post salt – as indicated in Figure 4. Seismic examples can be found in Figures 5 and 6.

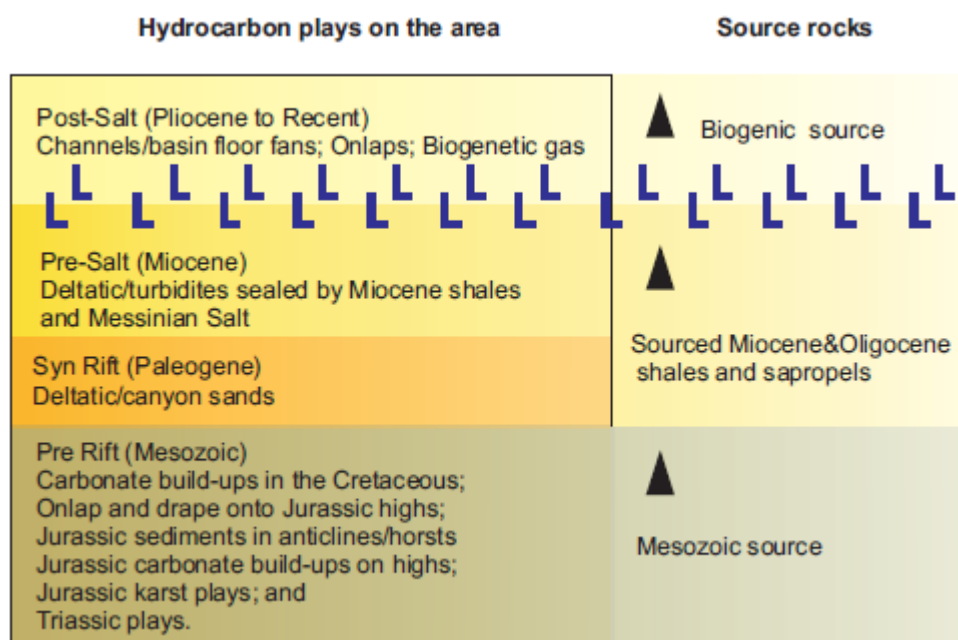


Fig 4: Hydrocarbon plays in the study area (Shtukert et al, 2014)

Figs 5 & 6: see overleaf

#### Conclusion:

Evidence from vintage seismic data and reported satellite seep surveys, together with petroleum system modelling point to the West Mediterranean Salt Basin being a petroleum generating province. Plans are underway to acquire new long offset 2D multi-client seismic data (plus gravity and magnetic data) in the Basin. This will allow companies to more fully evaluate the area and apply for acreage.

#### References:

Roberts, G.F & Christoffersen, T (2013): The West Mediterranean Salt Basin – A Future Petroleum Producing Province. Search and Discovery Article #50791 (Adapted from an extended abstract prepared in conjunction with a poster presentation at the AAPG Annual Convention and Exhibition, Pittsburgh, Pennsylvania, 2013).

Shtukert, O; Schenk, O; Silenziario, C; Milne, G (2014): Prospect and play justification in undrilled areas in the Balearic Sea using 2D Seismic analogies from other known productive areas. Presented at 'Mesozoic and Cenozoic carbonates of the neo-Tethys: old and new concepts for petroleum exploration'; 25-26 March 2014, Naples, Italy.

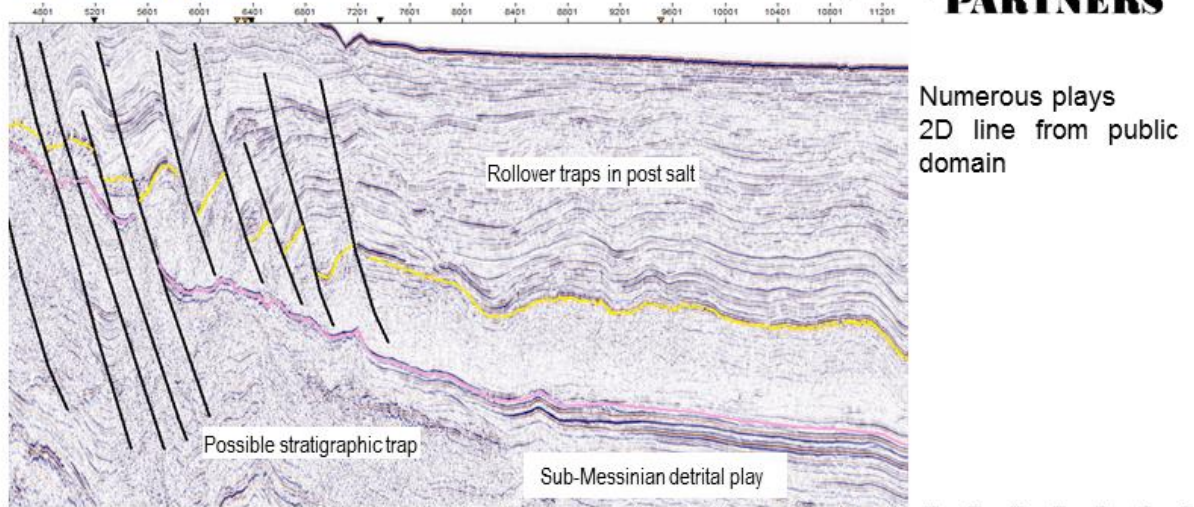
The other references may be found within these 2 papers.

Contacts:

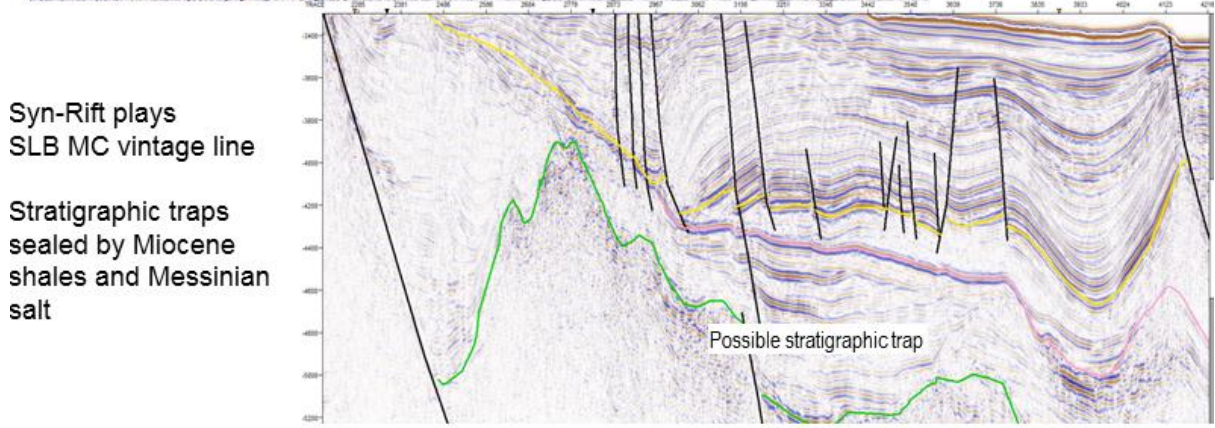
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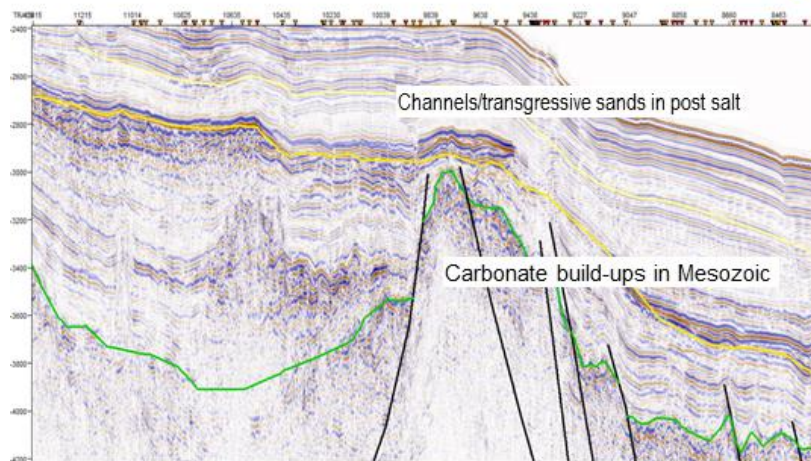


Numerous plays  
2D line from public domain



Syn-Rift plays  
SLB MC vintage line

Stratigraphic traps sealed by Miocene shales and Messinian salt



Pre-Rift plays  
SLB MC vintage line

Carbonate build-ups in Mesozoic. The Upper Jurassic limestones and Lower Cretaceous shallow marine carbonates (limestones and dolostones) are the main reservoir in the Casablanca oil field, located in shallow water.

**North Balearic Basin: SLB MC Vintage repro 2012 data & public domain examples**

Fig 5: Vintage seismic data examples (Displays courtesy of Schlumberger Multiclient)

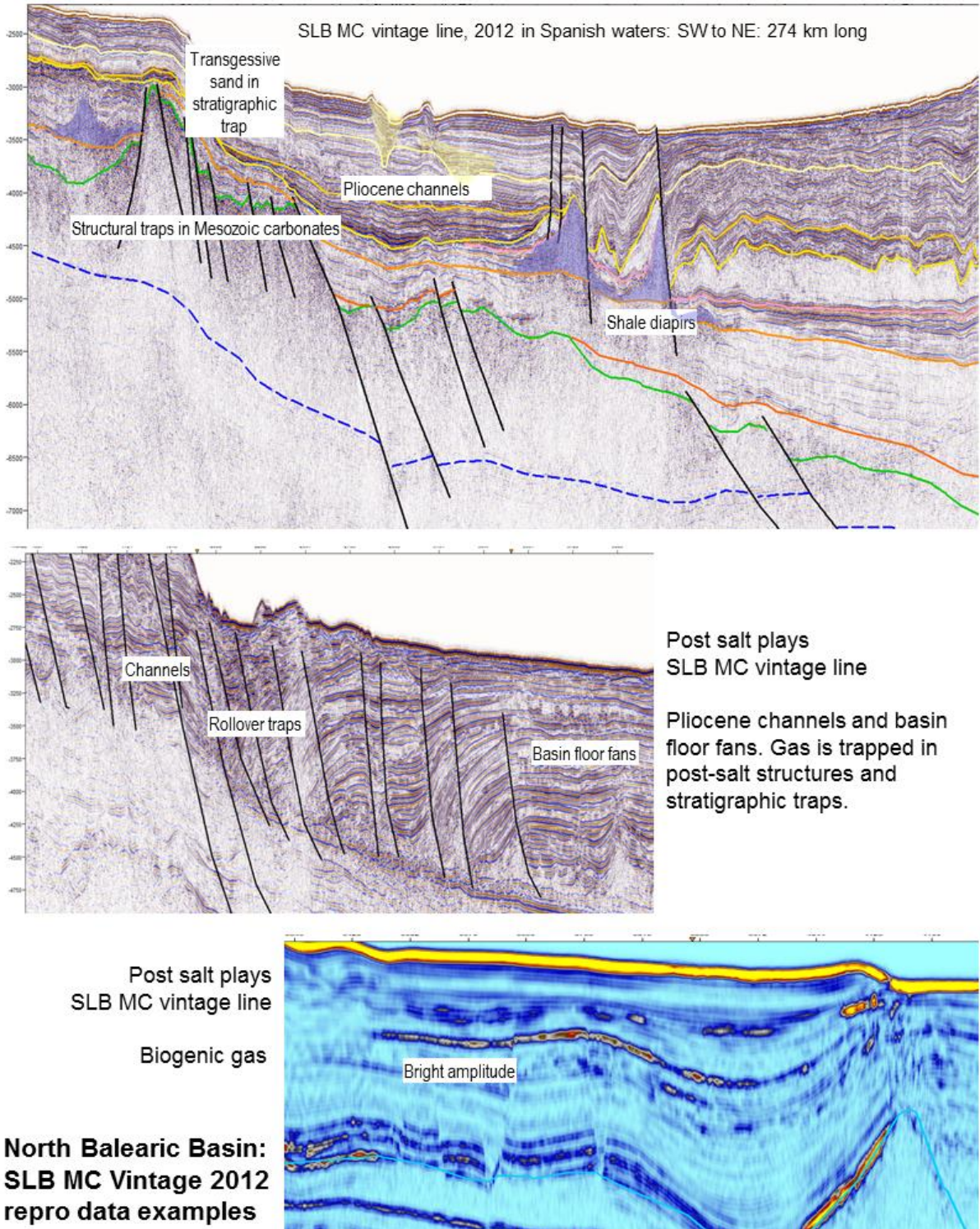


Fig 6: Vintage seismic data examples (Displays courtesy of Schlumberger Multiclient)