The West Mediterranean Salt Basin – A Future Petroleum Producing Province?*

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Abstract

With the recent exploration successes in the Eastern Mediterranean (offshore Egypt, Israel and Cyprus), attention is now being drawn to other areas of the Mediterranean. This poster presentation looks at one of those areas which we have named 'The West Mediterranean Salt Basin' (WMSB) and which lies between the eastern coasts of France & Spain and the west coast of Sardinia and Corsica (Figure 1). It includes the Valencia Trough, North Balearic Basin, Gulf of Lions and the Liguro-Provencal Basin (Roca 2002); and runs southwards into the North Algerian Basin

Introduction

The study is based on work carried out by the authors in the planning of a new long offset multi-client seismic survey in Spanish waters (in the North Balearic Basin). For this, vintage seismic data was obtained from the Spanish authorities and depth conversion carried out (Figure 2).

Depth conversion of this data shows a Messinian (i.e. Upper Miocene) salt package of typically 1,000 to 3,000m thickness, overlying up to 3,000m of sediments of presumably Oligocene to Miocene age (these are believed to lie on Oceanic crust in the deepest part of the basin and on a rifted Mesozoic continental crust on its margins – Bache et al 2010). The salt is overlain by 2,000m plus of younger sediments. The salt has however been affected by gravity sliding (Figure 3) and we see classic (Vendeville 2005) areas of upslope extension i.e. salt pinchout (near the East coast of Spain); midslope translation and downslope contraction (diapirism) in the centre of the basin. These correspond to the three provinces described in the adjacent Gulf of Lions by Ianev et al (2007): rollover anticline, salt pillows, and salt diapirs.

A typical NW-SE vintage seismic section is shown in Figure 4. This has been converted from Time to Depth by the authors using a depth stretch routine and a 3D velocity field.

In the study area, we recognise three petroleum systems. They are listed below, together with associated plays:

- Pliocene/Quaternary Petroleum system - biogenic source: Post Rift/Post Salt plays: deltaics, turbidites and channel sands in structural and stratigraphic traps.
- Pre Messinian (Oligocene/Miocene) Petroleum system -sourced from Oligocene/Miocene sapropels (i.e. organic rich muds - USGS 2004) and shales. Post Rift/Pre Salt plays: deltaic/ turbidites sealed by Miocene shales and Messinian salt. Syn Rift: canyon sands and deltaics.
- Pre Tertiary Petroleum system: 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).

The relationship between the petroleum systems and plays is shown diagrammatically in Figure 5, which is based on Ianev et al's 2007 paper on the Gulf of Lions and the work, which Melrose did on their Rhone Maritime concession, which lies in French waters adjacent to our study area

DHI's have been recognised in the seismic data and the presence of seeps has been noted by other authors (Ianev et al 2007) – the seeps occurring where the salt has either soled out or been broken up by diapirism. Some of the plays seen on the vintage data in the North Balearic Basin are shown overleaf in Figure 6, Figure 7 and Figure 8.

Summary

Work done in the study area shows that the WMSB is undoubtedly 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 in the second half of 2013. This will allow companies to more fully evaluate the area and possibly bid for acreage.

Acknowledgements

Acknowledgements and thanks are due to CIESM, Lofi et al (2011) and Ianev et al (2007) for use of their figures.

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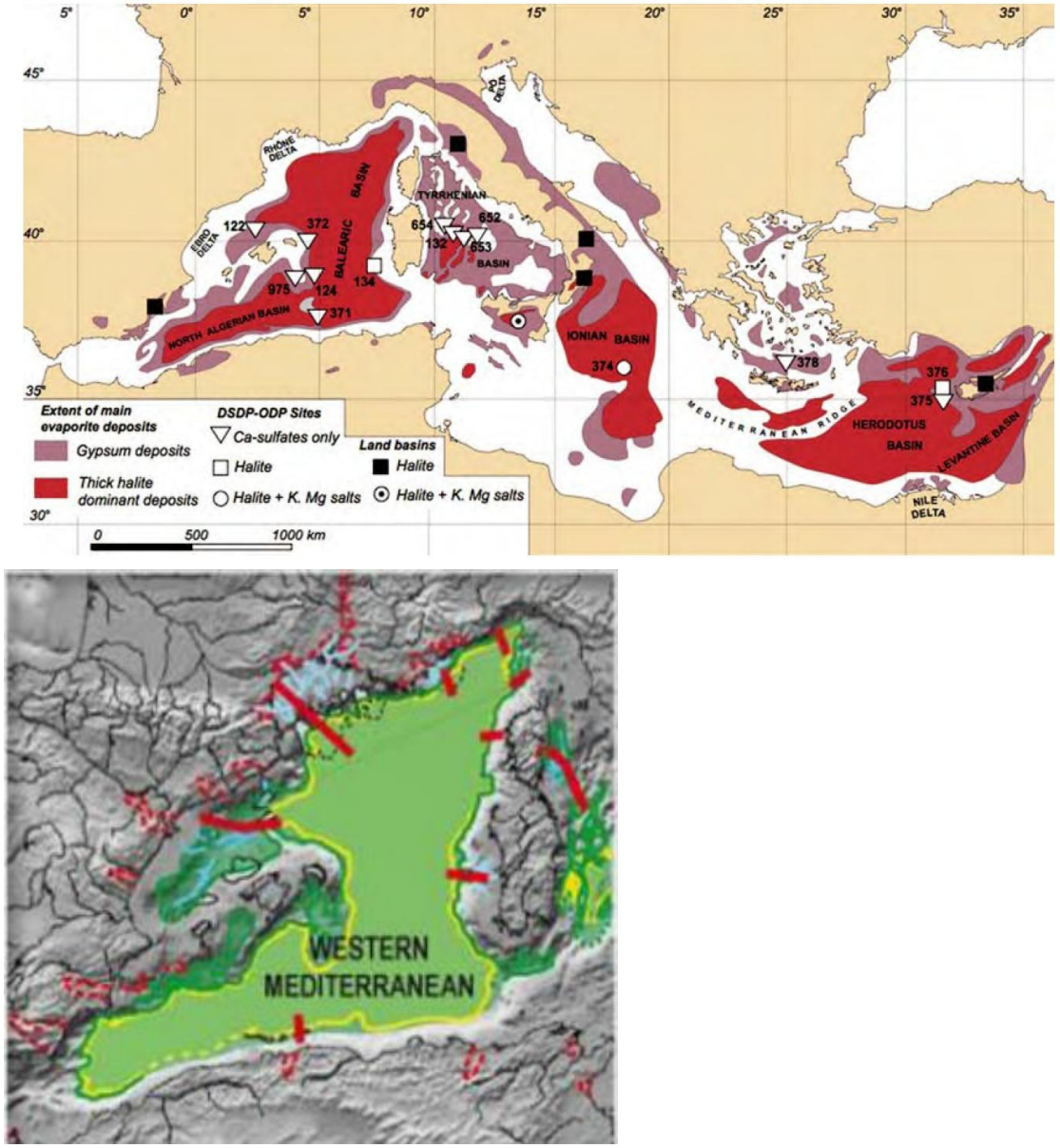

Figure 1. A) Upper Figure: distribution of Messinian Evaporites in the Mediterranean (CIESM 2008 – modified from Rouchy and Caruso 2006). B) Outline of WMSB (Lofi et al 2011 Atlas).

Figure 2. Study area showing Spec Partners' new proposed MC2D seismic Grid.

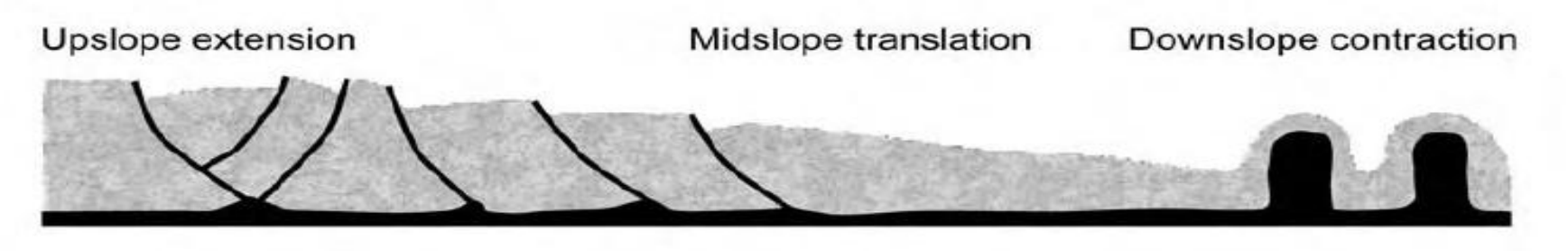

Figure 3. Structural domains associated with salt tectonics (CIESM 2008, based on Vendeville 2005).

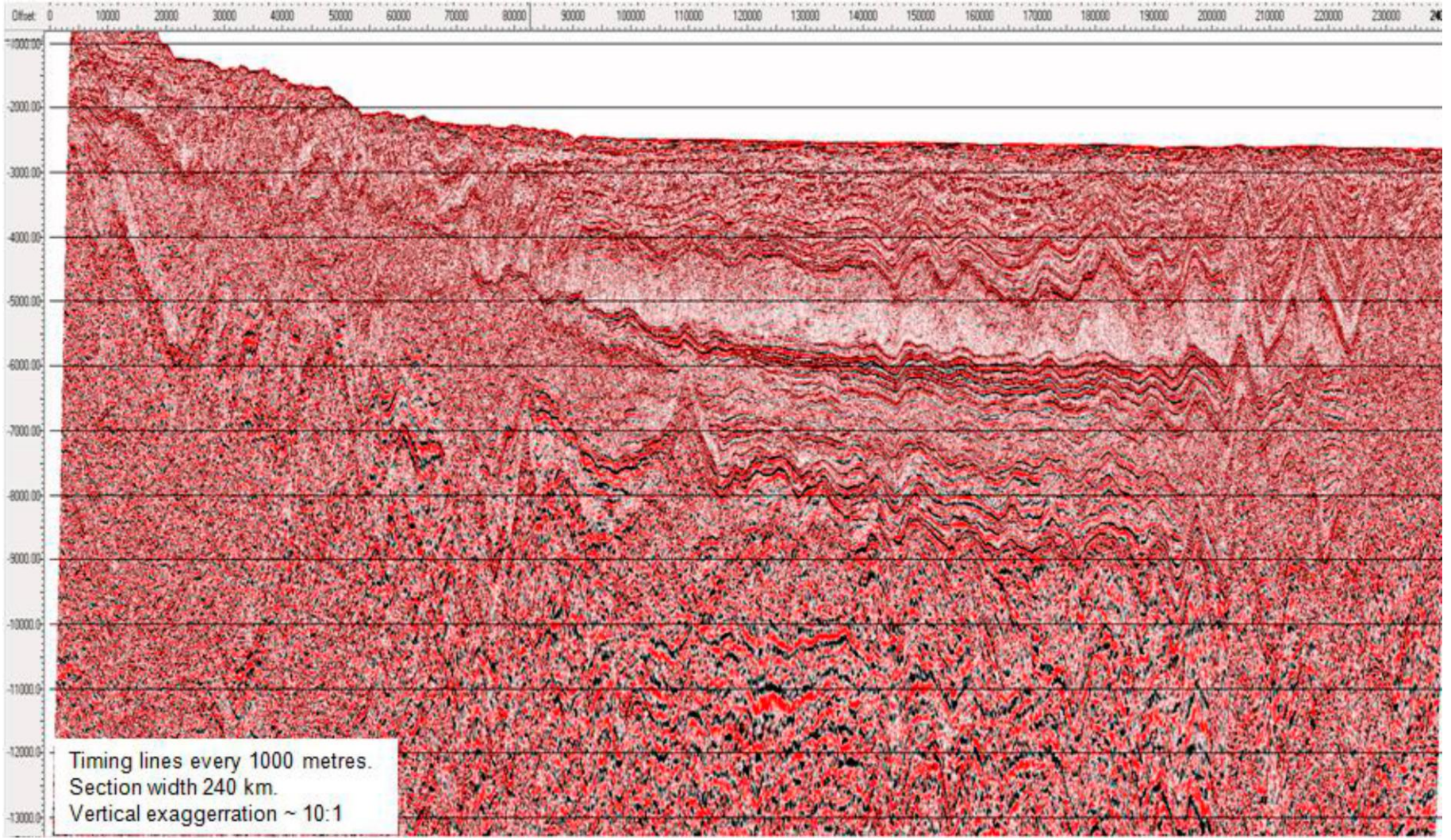

Figure 4. Vintage seismic line in the North Balearic Basin – converted from Time to depth. Timing lines every 1,000 metres. Section width approximately 240 kms.

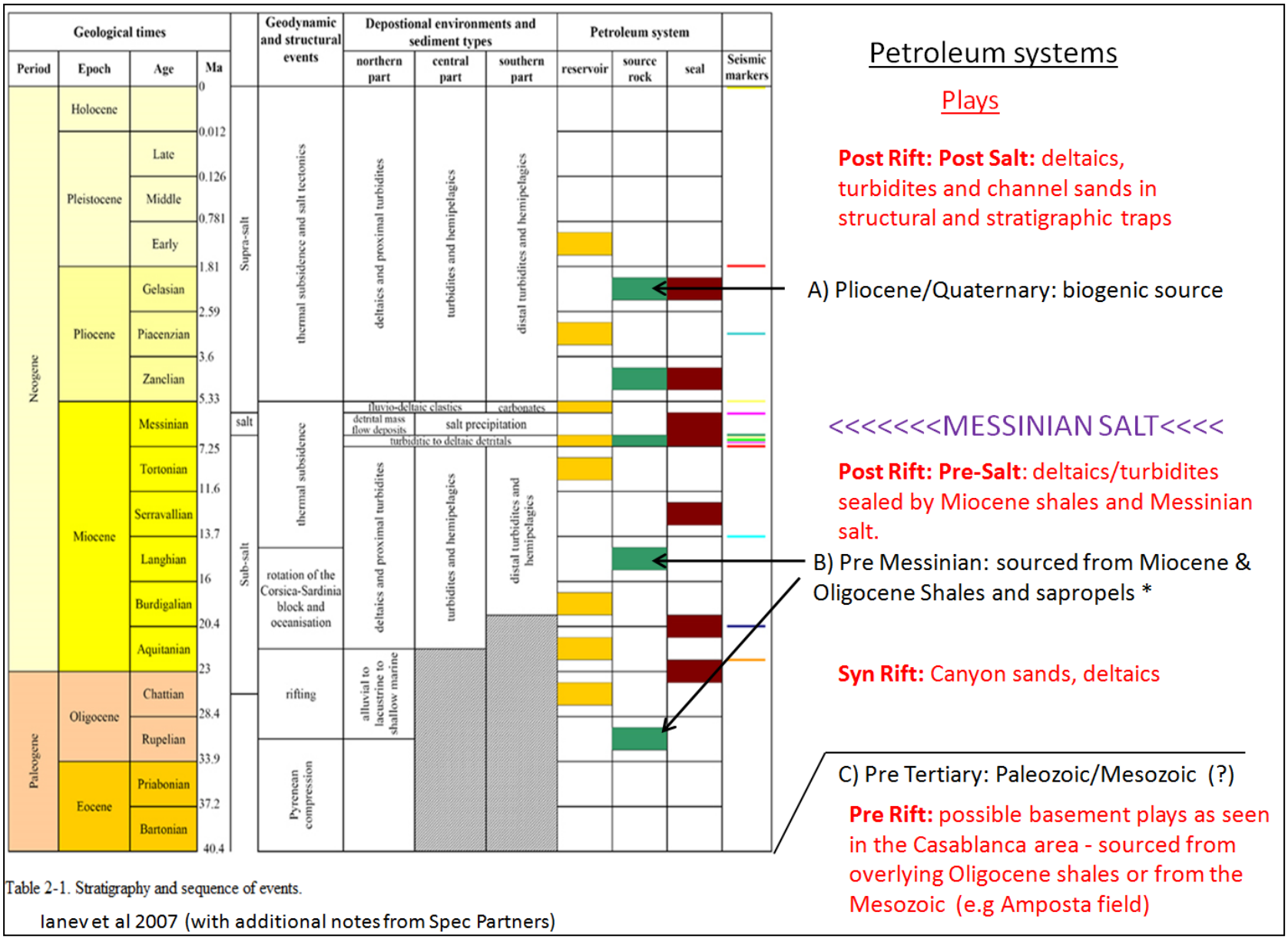

Figure 5. North Balearic Basin: Petroleum Systems and Plays.

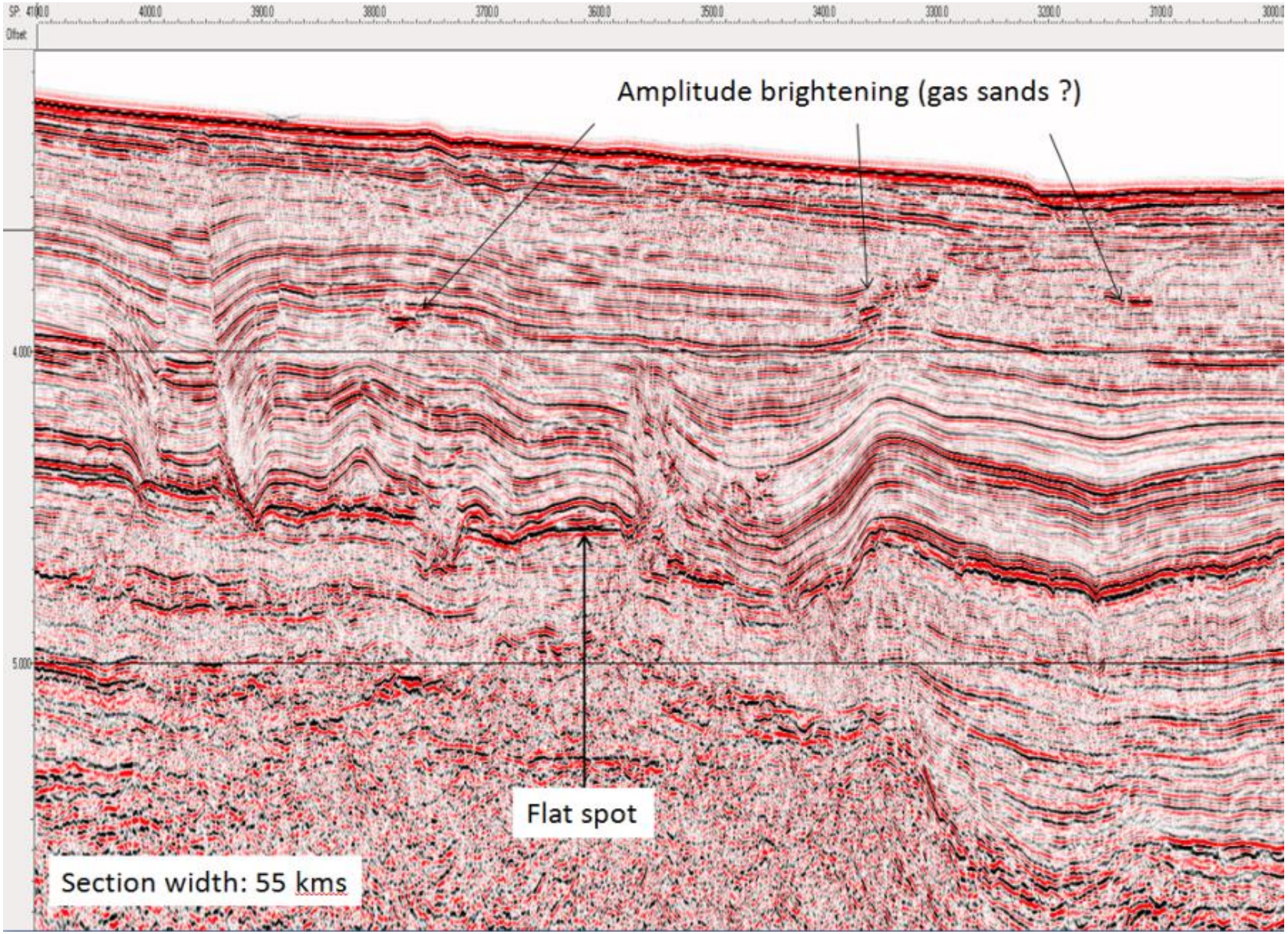

Figure 6. Post salt plays - on the slope, the salt starts to thin and break-up. Gas is trapped in post-salt structures and stratigraphic traps.

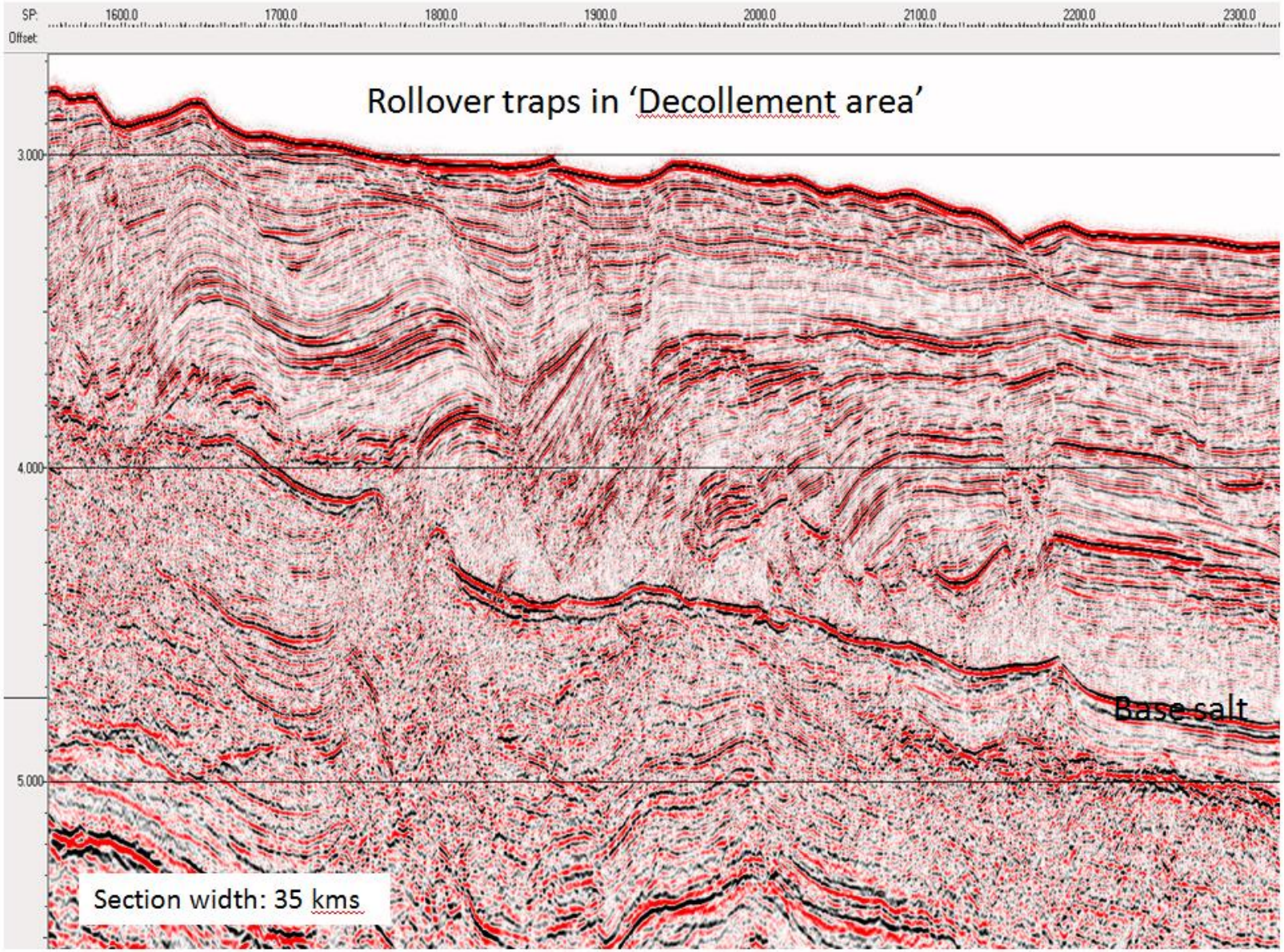

Figure 7. Post Salt Structural traps in the Upslope area.

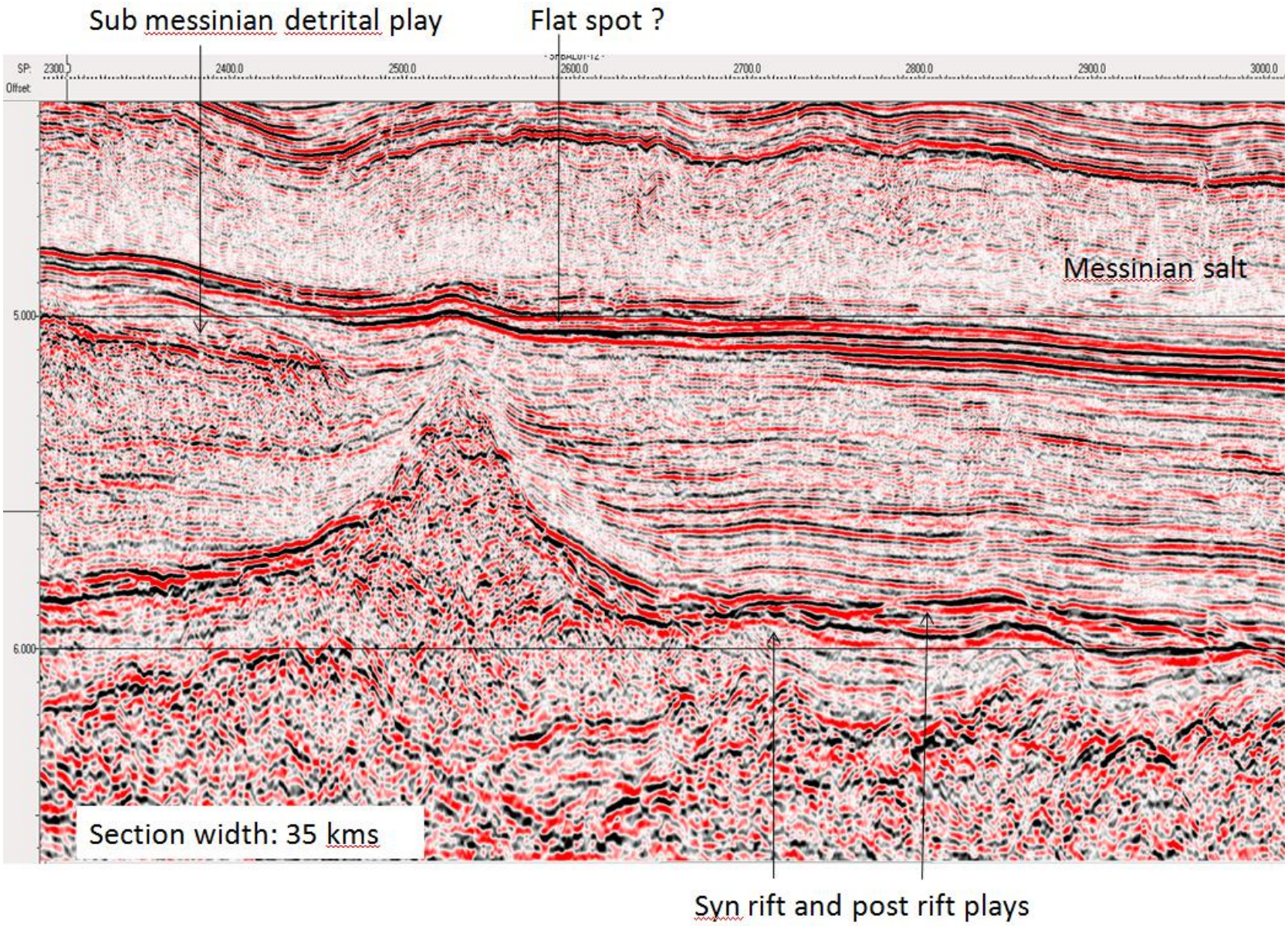

Figure 8. Pre salt plays - the syn and post rift plays overlying a possibly volcanic basement, which has also, lead to onlap and differential compaction.