Intraslope basin stratigraphy documents the evolution of salt wall growth in the Lower Congo Basin, offshore Angola

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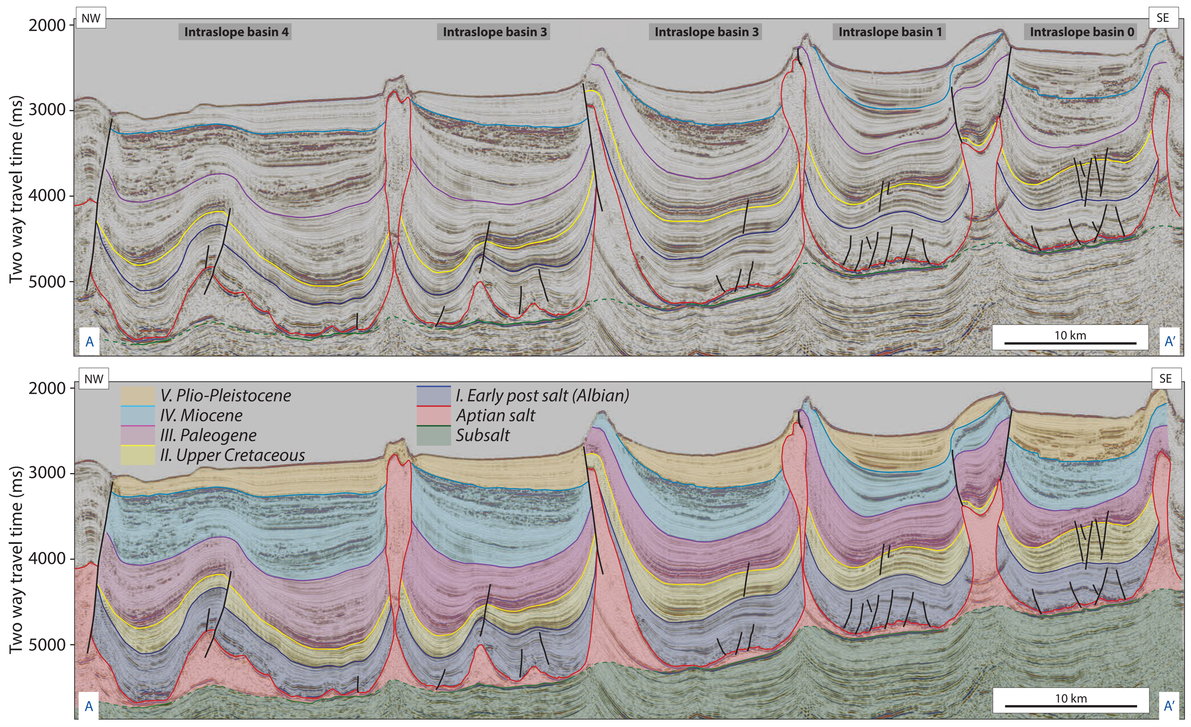
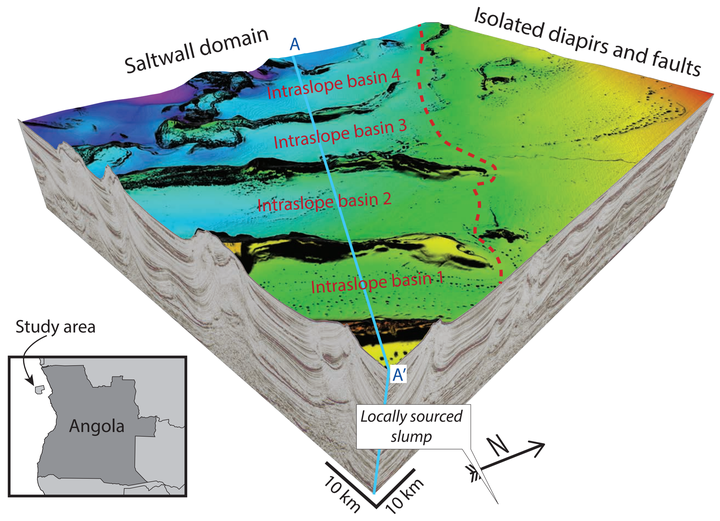
INTRODUCTION

Post-salt stratigrapy in the Lower Congo Basin provides a detailed insight into the evolution of elongate salt walls from the late Cretaceous to the present. A large number of horizons were generated from 3D reflection seismic surveys using a commercial, semi-automatic, geo-model based interpretation technique. Visualising these horizons and associated time thickness, variance and amplitude maps allows us to analyze structural, thickness and depositional trends in the intraslope basins and their implications for the evolution of the salt walls through time.

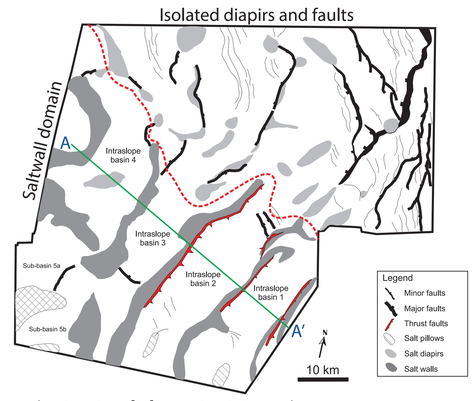
GEOLOGICAL FRAMEWORK

The evaporites of the Aptian-Barremian Loeme Formation in the Lower Congo Basin are overlain by carbonates, marls and clays of the Albian to Late Cretaceous age followed by a thick sequence of predominantly clastic sediments (Late Cretaceous to present) (Broucke et al. 2004). The structural style in the post salt section in this area is typical for gravitational gliding with extensional and compressional structures in the upslope and downslope domaines respectively. This deformation started during the Albian and continues to the present day (Valle et al. 2001, Fort et al. 2004, Oluboyo et al. 2013) as evidenced by the presence of active structures on the present day seabed.





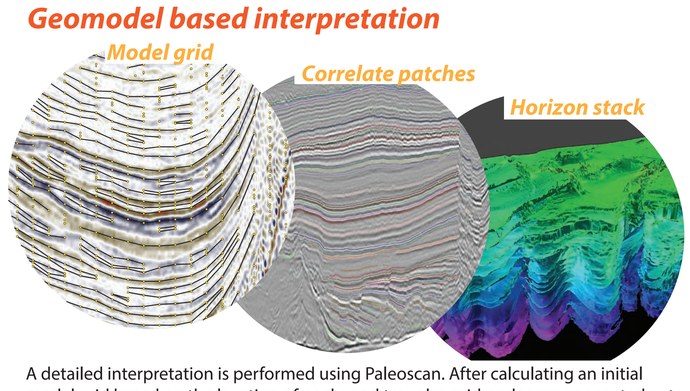
In an earlier study, Oluboyo et al. (2015) described the interaction of submarine gravity flows and the evolving salt-related topography in the study area during the Miocene. We extend this work to the entire post-salt sequence and adopt the same nomenclature for the main structural elements.



Main structural elements at top Miocene
From Oluboyo et al. 2013

METHODOLOGY

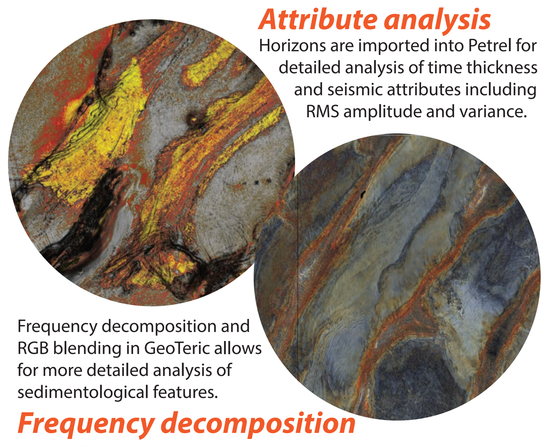
Geomodel based interpretation



A detailed interpretation is performed using Paleoscan. After calculating an initial model grid based on the location of peaks and troughs, grid nodes are connected automatically and the resulting patches can be further correlated manually. The end result is a horizon stack that can contain any number of surfaces (200 in this study).

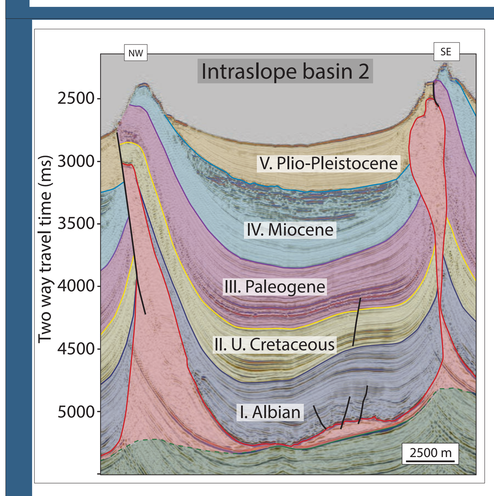
Attribute analysis

Horizons are imported into Petrel for detailed analysis of time thickness and seismic attributes including RMS amplitude and variance.

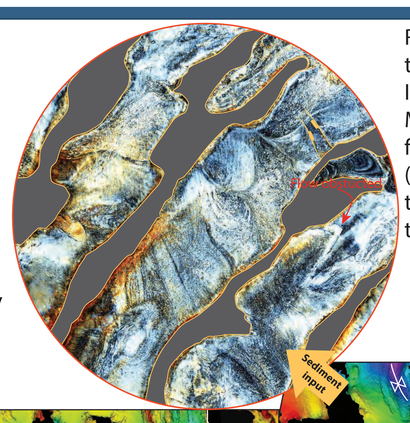


Frequency decomposition and RGB blending in GeoTeric allows for more detailed analysis of sedimentological features.

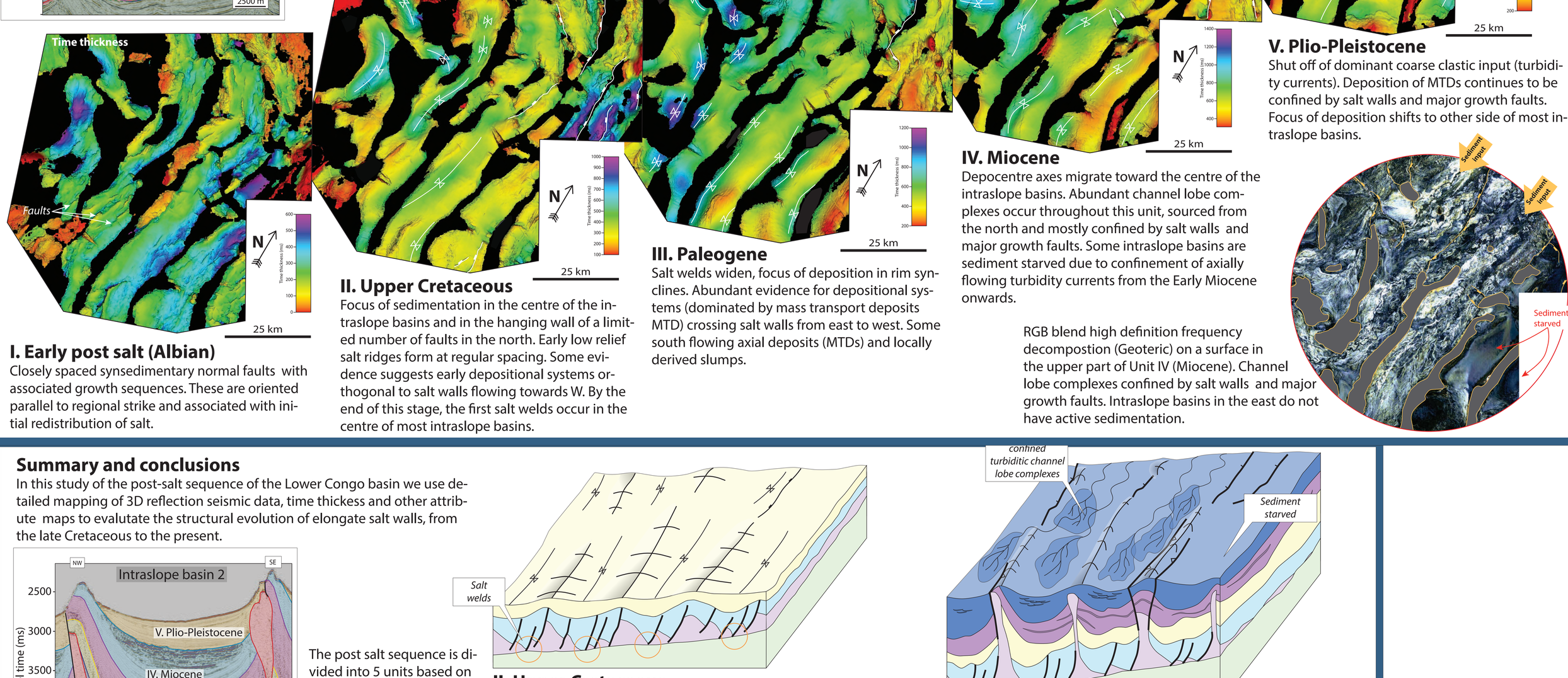
Frequency decomposition and RGB blending



The post salt sequence is divided into 5 units based on time thickness variations and the type and dominant orientation of depositional systems within these units. On the time tickness maps shown below the main depositional centers in the intra slope basins are indicated by synclines. The most important active faults are also marked.



RGB blend of high definition frequency decompostion (GeoTeric) on a surface in the lower part of Unit III (Paleogene).
Mottled appearance corresponds to chaotic seismic facies and is characteristic of mass transport deposits (MTD). Direction of transport is from the east. Although obstructed by the salt walls, in many cases these deposits also cross the salt walls.



I. Early post salt (Albian)

Closely spaced synsedimentary normal faults with associated growth sequences. These are oriented parallel to regional strike and associated with initial redistribution of salt.

II. Upper Cretaceous

Focus of sedimentation in the centre of the intraslope basins and in the hanging wall of a limited number of faults in the north. Early low relief salt ridges form at regular spacing. Some evidence suggests early depositional systems orthogonal to salt walls flowing towards W. By the end of this stage, the first salt welds occur in the centre of most intraslope basins.

III. Paleogene

Salt welds widen, focus of deposition in rim synclines. Abundant evidence for depositional systems (dominated by mass transport deposits MTD) crossing salt walls from east to west. Some south flowing axial deposits (MTDs) and locally derived slumps.

IV. Miocene

Depocentre axes migrate toward the centre of the intraslope basins. Abundant channel lobe complexes occur throughout this unit, sourced from the north and mostly confined by salt walls and major growth faults. Some intraslope basins are sediment starved due to confinement of axially flowing turbidity currents from the Early Miocene onwards.

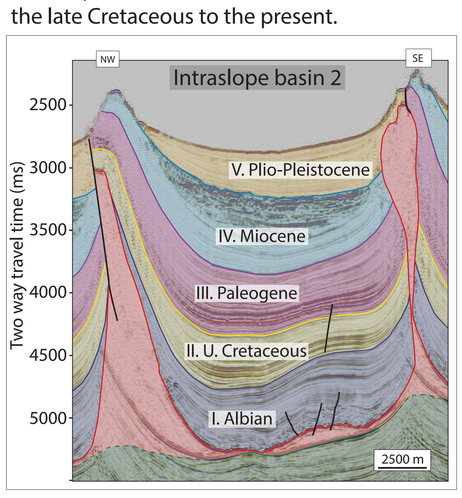
V. Plio-Pleistocene

Shut off of dominant coarse clastic input (turbidity currents). Deposition of MTDs continues to be confined by salt walls and major growth faults. Focus of deposition shifts to other side of most intraslope basins.

RGB blend high definition frequency decompostion (Geoteric) on a surface in the upper part of Unit IV (Miocene). Channel lobe complexes confined by salt walls and major growth faults. Intraslope basins in the east do not have active sedimentation.

Summary and conclusions

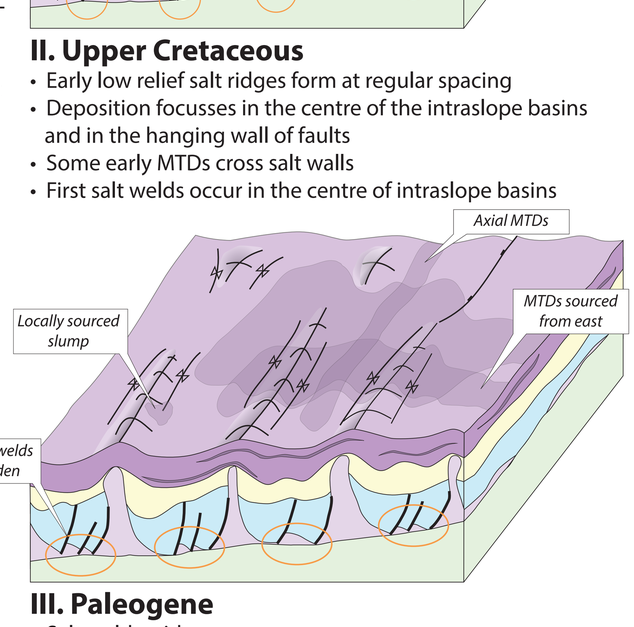
In this study of the post-salt sequence of the Lower Congo basin we use detailed mapping of 3D reflection seismic data, time thickness and other attribute maps to evalutate the structural evolution of elongate salt walls, from the late Cretaceous to the present.



The post salt sequence is divided into 5 units based on time thickness variations and the type and dominant orientation of depositional systems within these units.

II. Upper Cretaceous

- Early low relief salt ridges form at regular spacing
- Deposition focusses in the centre of the intraslope basins and in the hanging wall of faults
- Some early MTDs cross salt walls
- First salt welds occur in the centre of intraslope basins



III. Paleogene

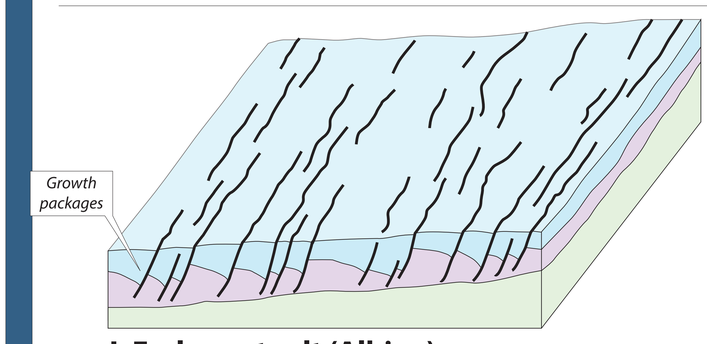
- Salt welds widen
- Focus of deposition in rim synclines
- Most depositional systems cross salt walls
- Some south flowing axial deposits (MTDs) and locally derived slumps

IV. Miocene

- Depocentres migrate toward the centre of the intraslope basins
- Abundant channel lobe complexes confined by salt walls and major faults
- Some intraslope basins sediment starved from the Early Miocene

V. Plio-Pleistocene

- Focus of deposition migrates across to other side of most intraslope basins
- Shut off of dominant coarse clastic input
- Some deposition of MTDs continues to be confined by salt walls and major growth faults



I. Early post salt (Albian)

- Closely spaced synsedimentary normal faults
- Parallel to regional strike
- Initial redistribution of salt

References

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Acknowledgements

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