Evidence for the Onshore Extension of the Deep Water Jurassic Salt Basin in the Majunga Basin, Northwest Madagascar*

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Abstract

Previous models of basin development in western Madagascar have recognised a failed, Permo-Triassic, Karroo rift system lying landward of a Early Jurassic rift that developed into the Middle Jurassic to present day passive margin. Features of these models are 1) the thinness of the Jurassic rift sediments (0-800m), 2) their onlapping relationship to pre-existing Karroo tilted fault blocks, 3) their shaly nature, and 4) the absence of a well-defined Jurassic rift margin. These models have been developed mainly using data from the better explored Morondava Basin.

However, in contrast, a new integrated interpretation of the onshore part of the more northerly Majunga Basin highlights a sharply-defined fault margin to the Jurassic rift basin, extending for at least 200+ km parallel to the coast and a substantial thickness of Lower Jurassic rift sediments (500-3000+m) to the west of it.

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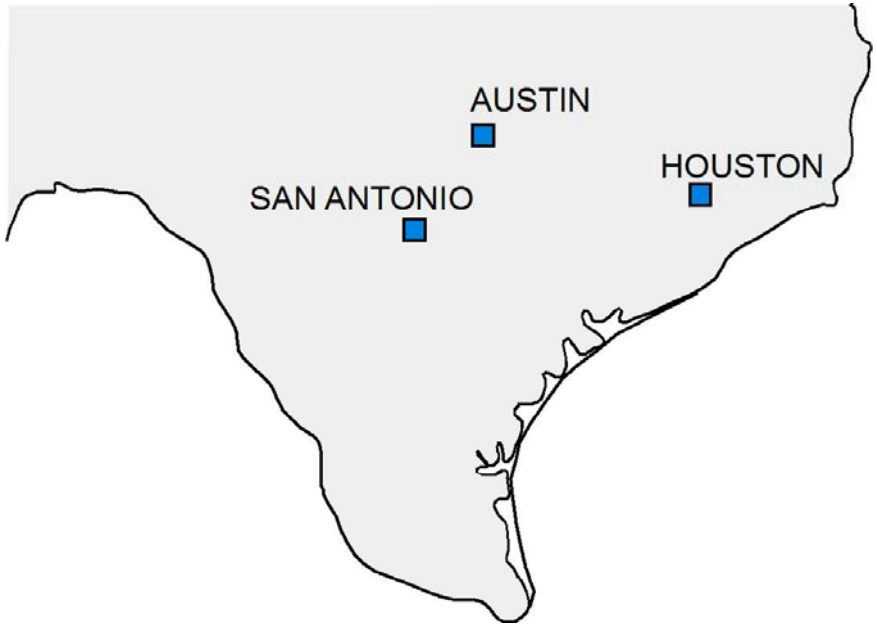
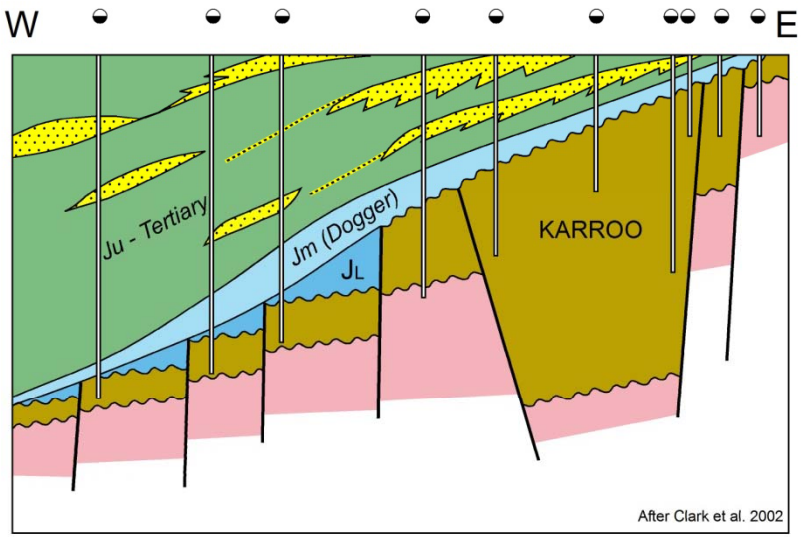
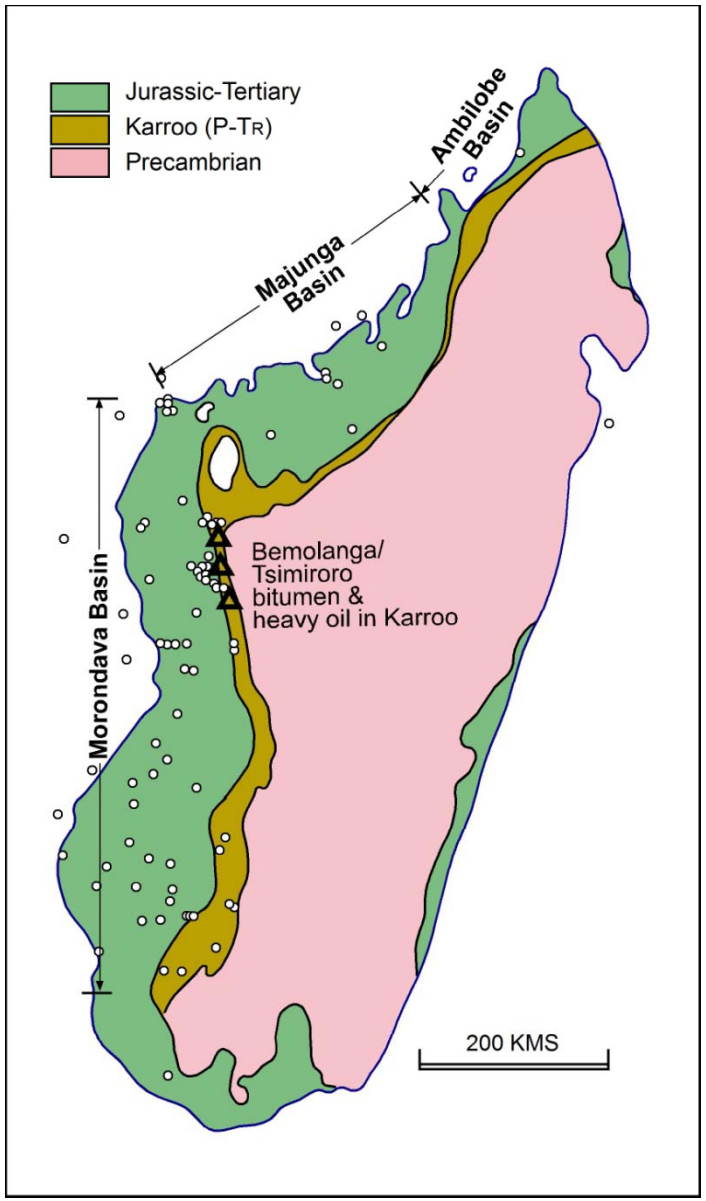
Outline

1. Regional geological context
2. Break-up of East & West Gondwanaland in the early Jurassic
   - ❖ Evidence for the extent and nature of early Jurassic rift sedimentation in the Majunga Basin
3. Implications for Madagascar's petroleum potential

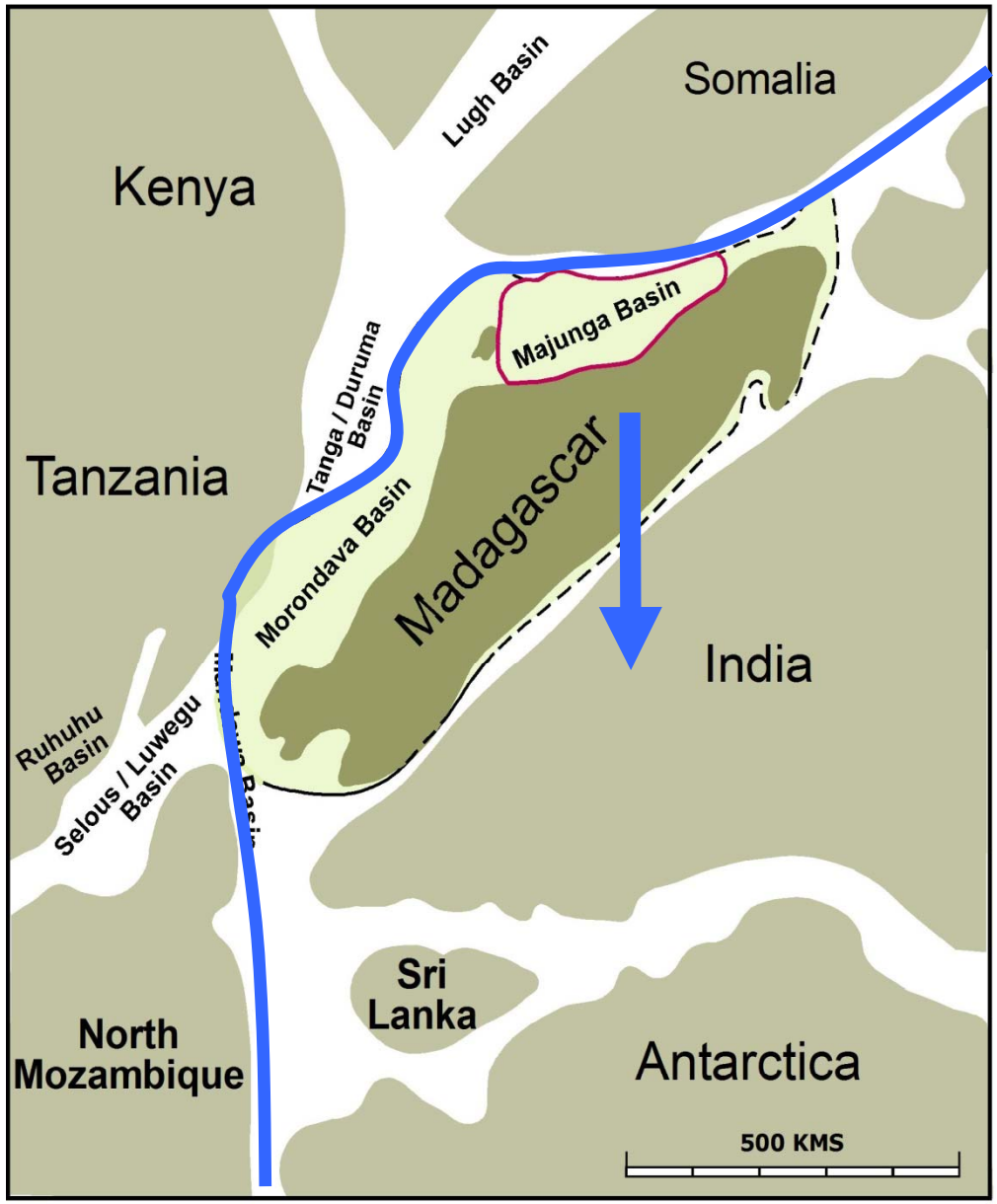
Onshore Geology Map and Cross-section







Madagascar within Gondwanaland (pre-Jurassic)



Reconstruction from Reeves et al. (2002)

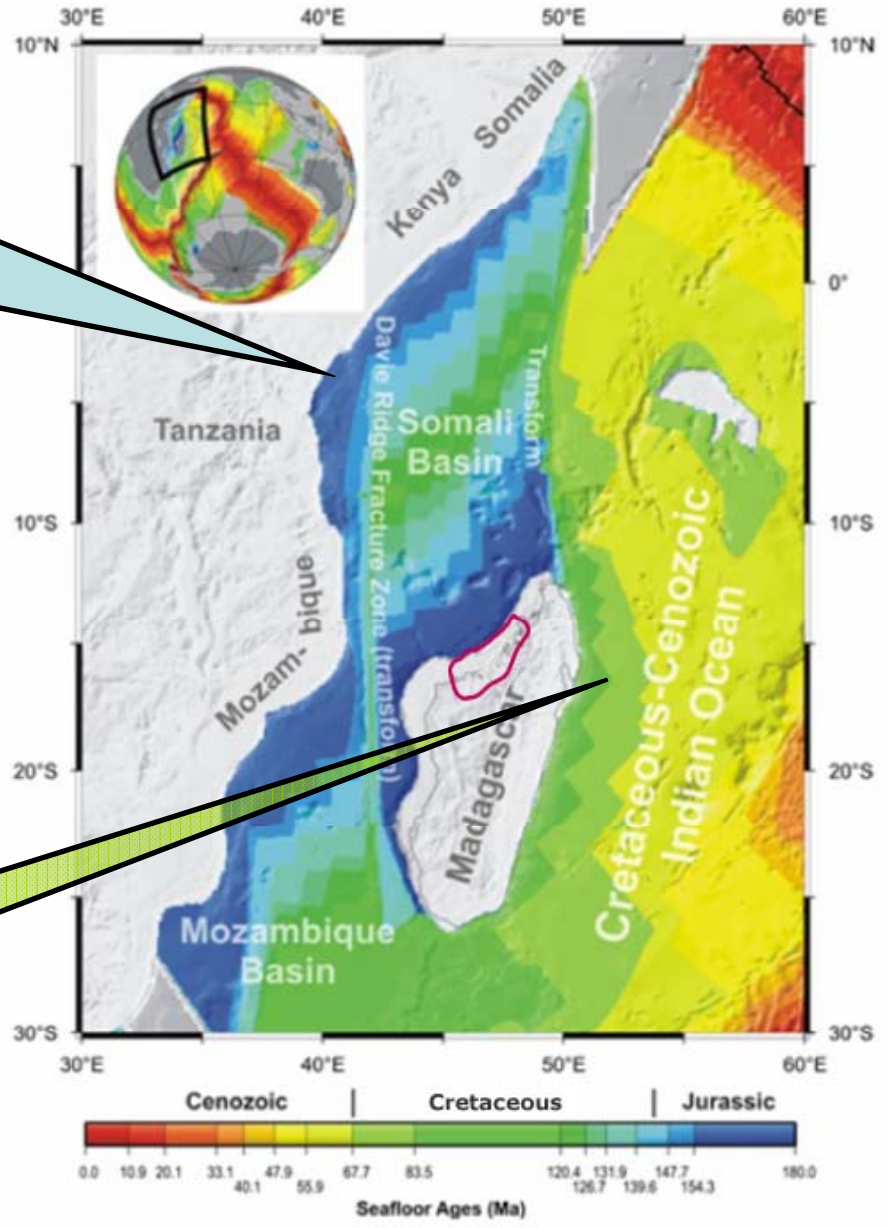
Break-up of Gondwanaland

Age of Oceanic Crust

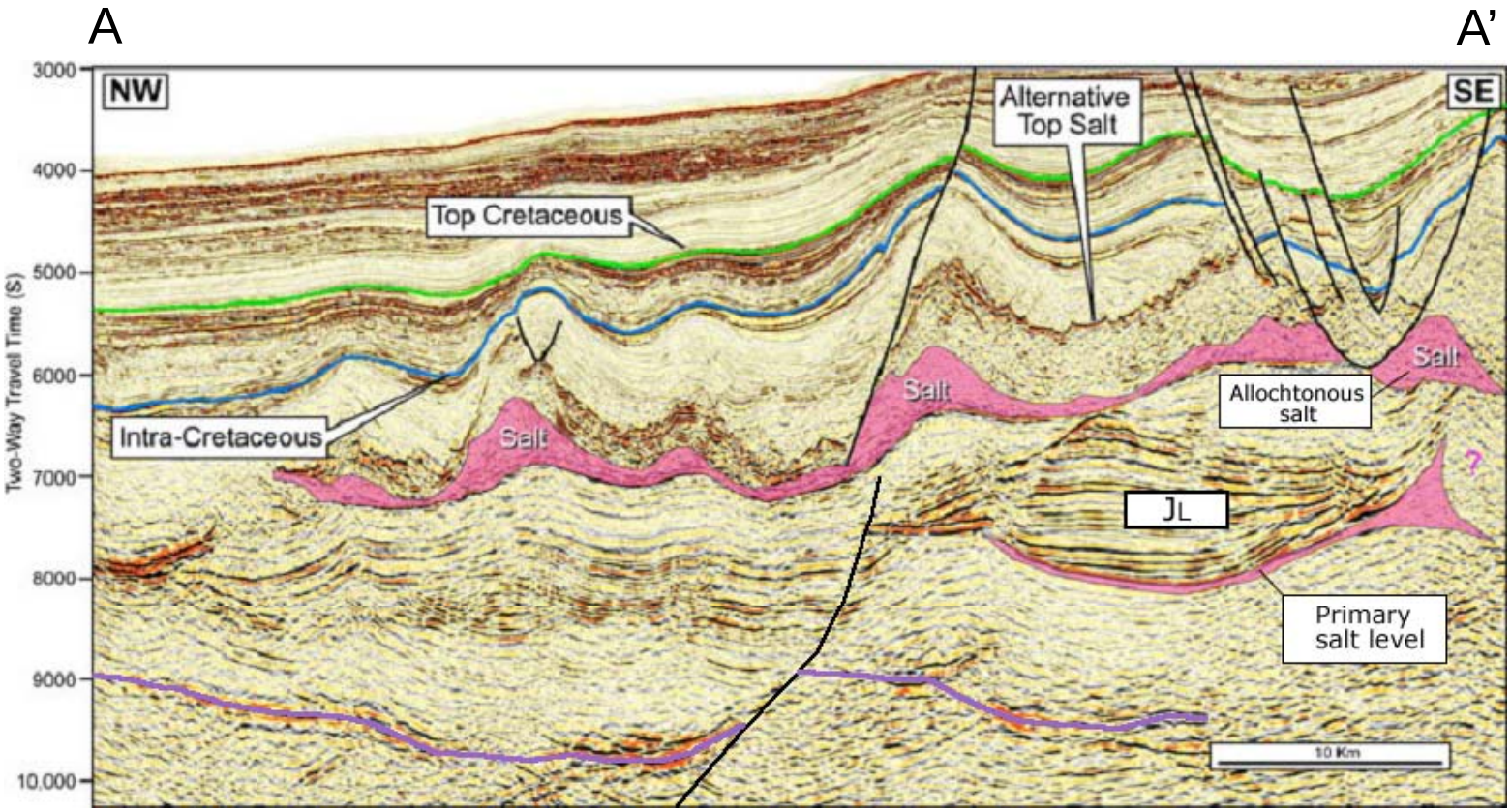
Early Jurassic: break-up of East Gondwanaland (Madagascar, India etc) and West Gondwanaland (Africa, etc). Movement was southward along the Davie Ridge FZ

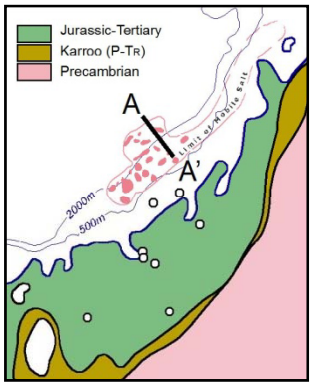
Note that the Majunga Basin Jurassic movement was an ***oblique rift*** *whereas the Morondava Basin movement was* ***transform****.* *<u>This caused significant differences in Jurassic rift sedimentation between the basins.</u>*

Late Cretaceous: break-up of India and Seychelles from Madagascar



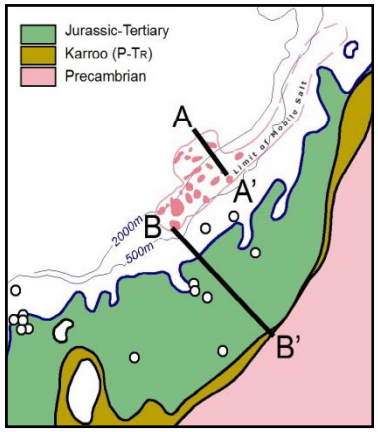
Deep water Majunga Basin seismic line

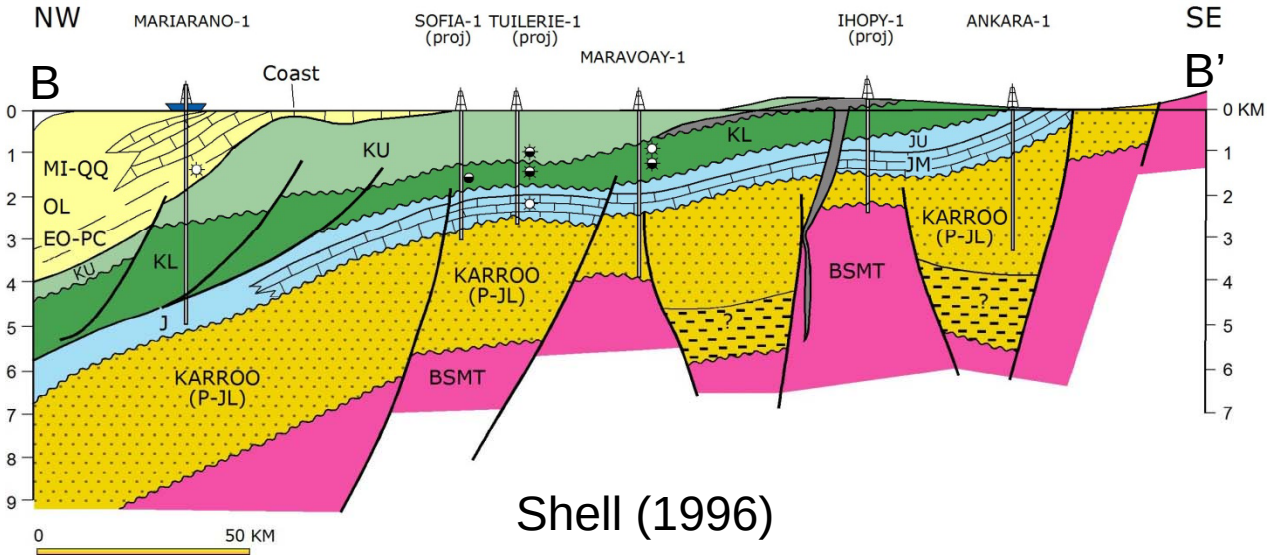




Adapted from Vanco website (2006)

Onshore Majunga Basin

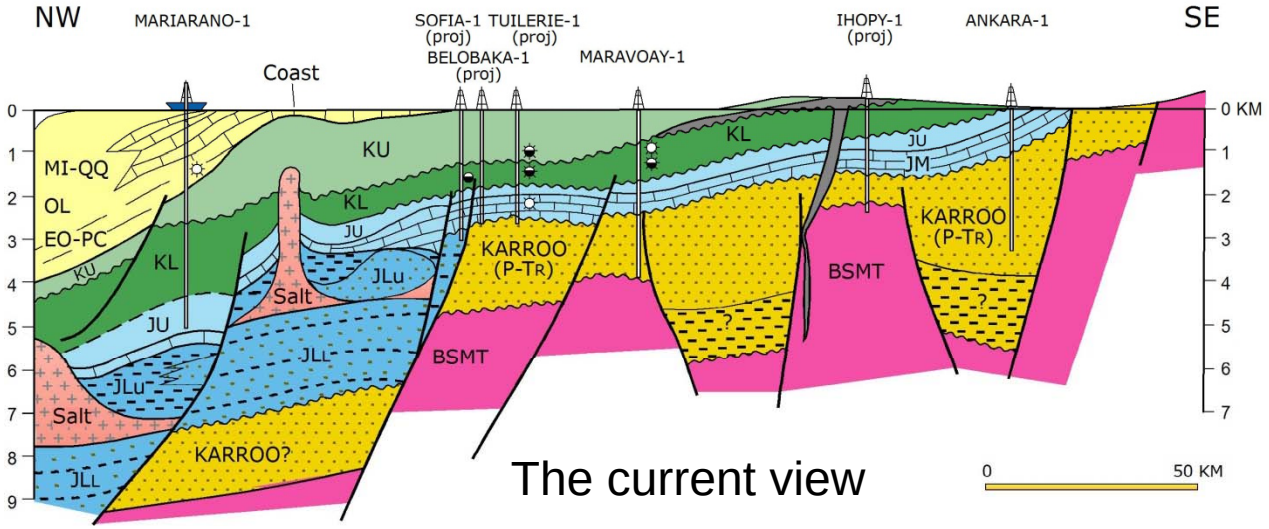




Shell (1996)

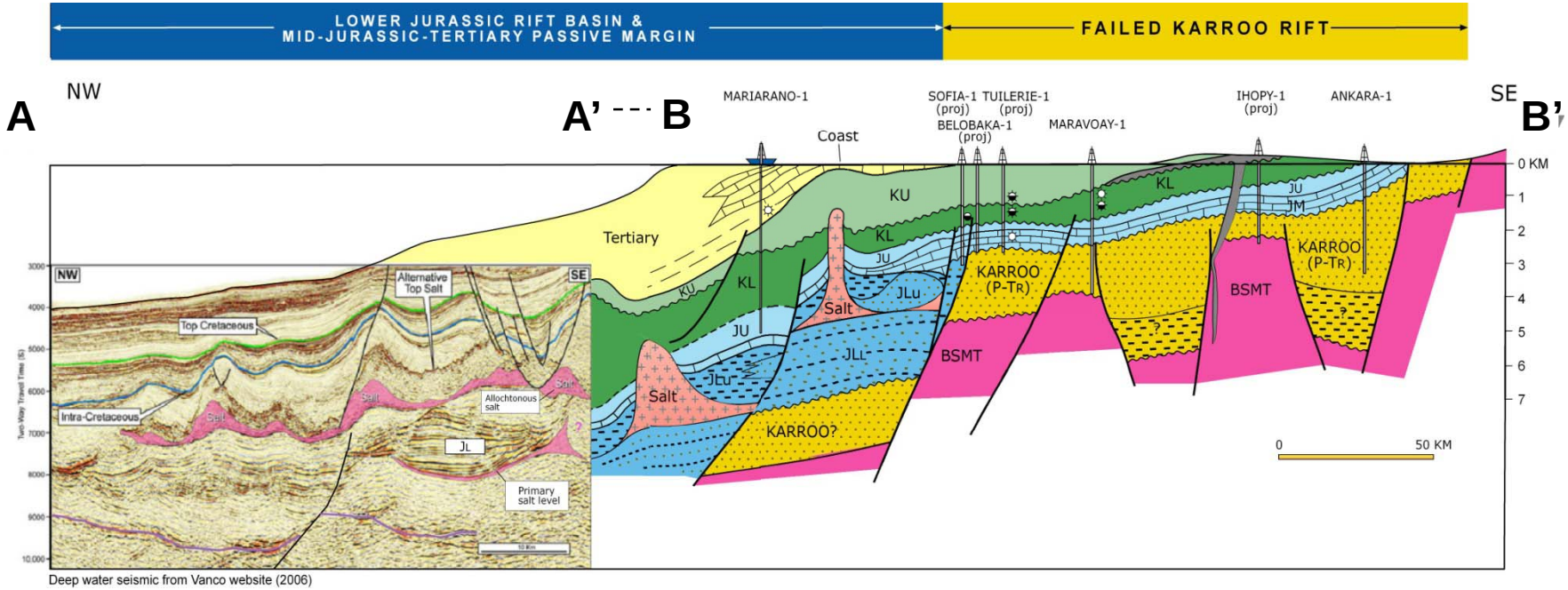
LOWER JURASSIC RIFT BASIN & MID-JURASSIC-TERTIARY PASSIVE MARGIN

FAILED KARROO RIFT

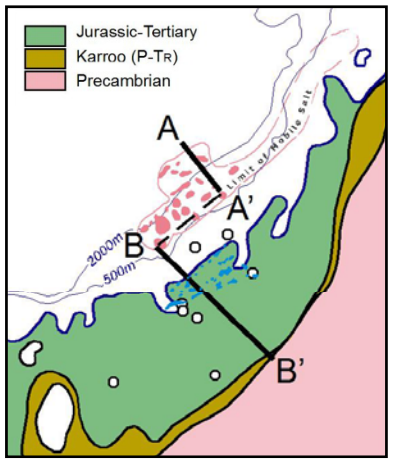


The current view

Schematic offshore-onshore cross-section

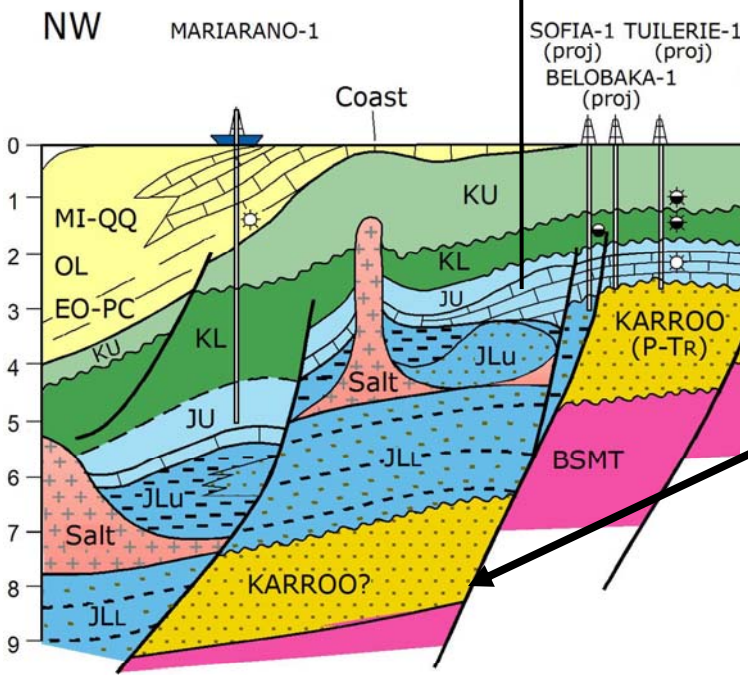


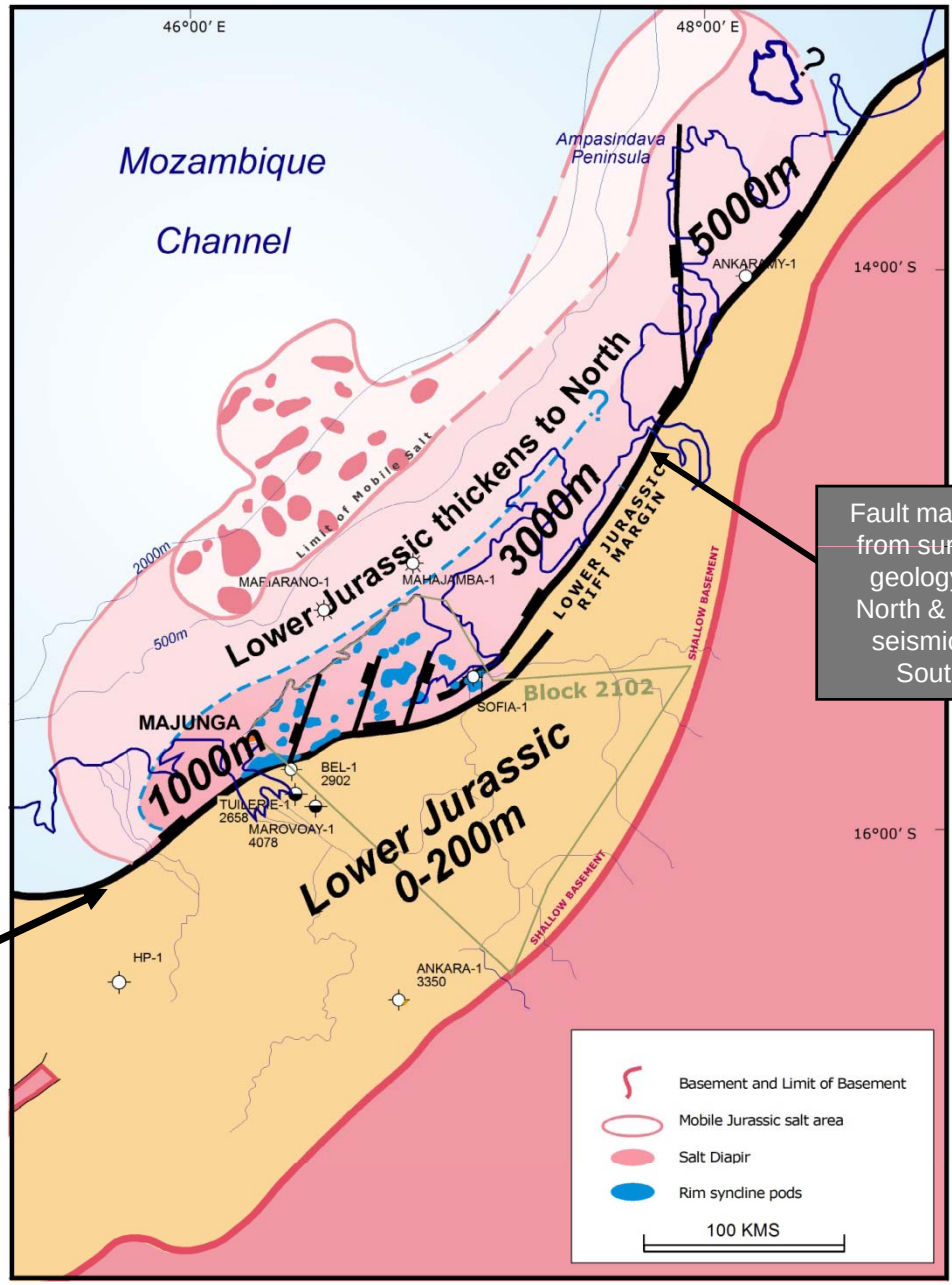
Deep water seismic from Vanco website (2006)



Majunga Basin Structural Elements

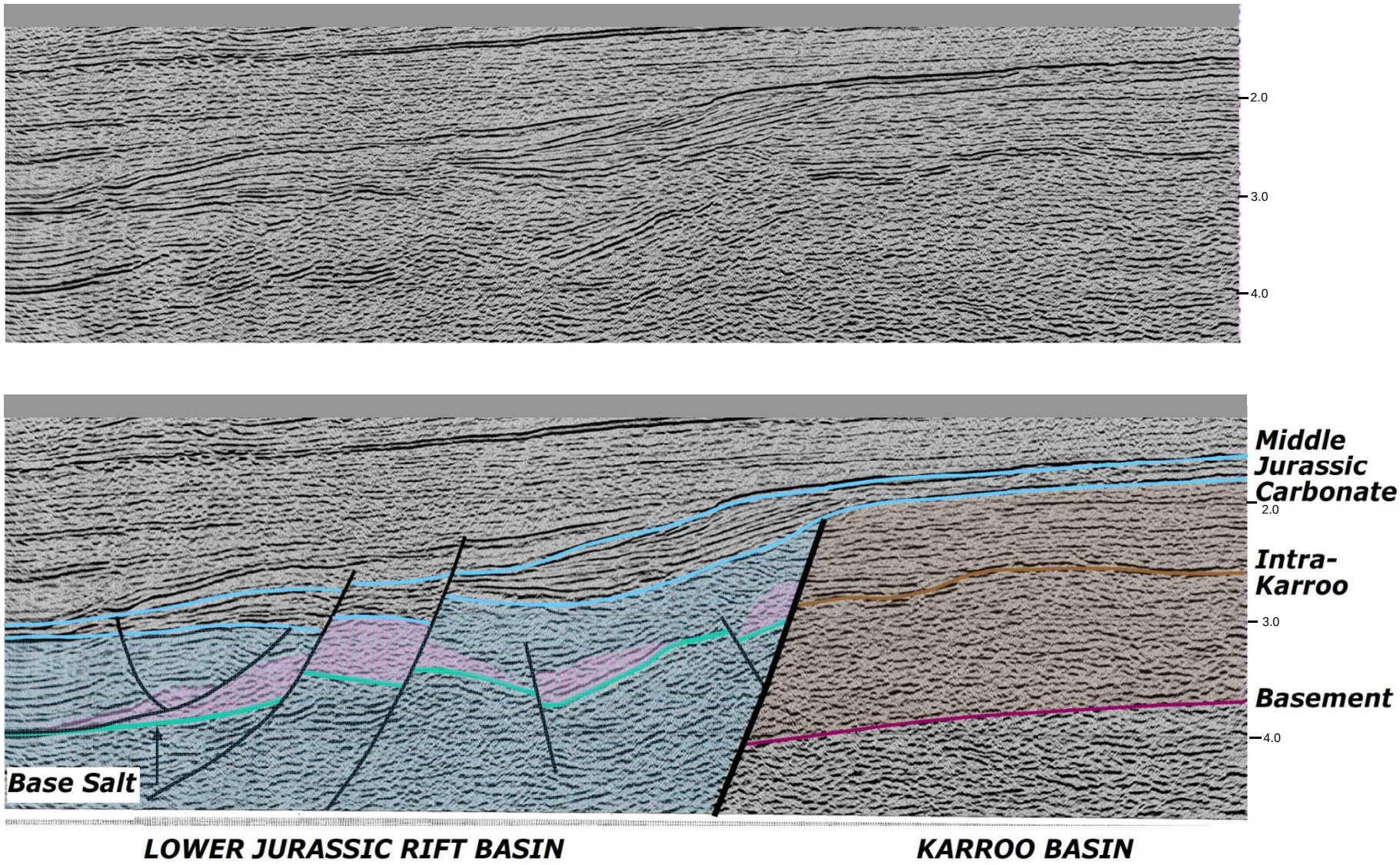
The Middle Jurassic ('Dogger') depositional shelf edge is controlled by the underlying Early Jurassic rift-margin fault



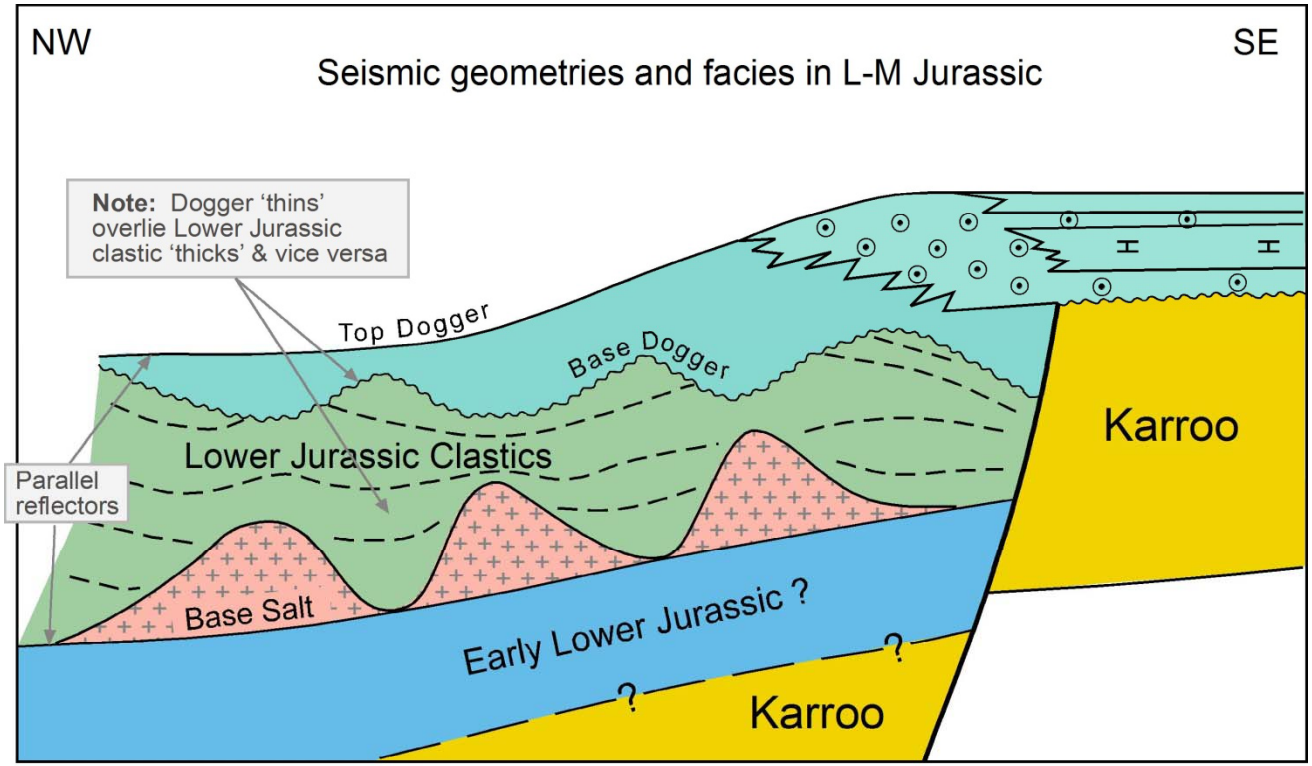


Fault mapped from surface geology to North & from seismic to South

Seismic line across the Jurassic rift margin



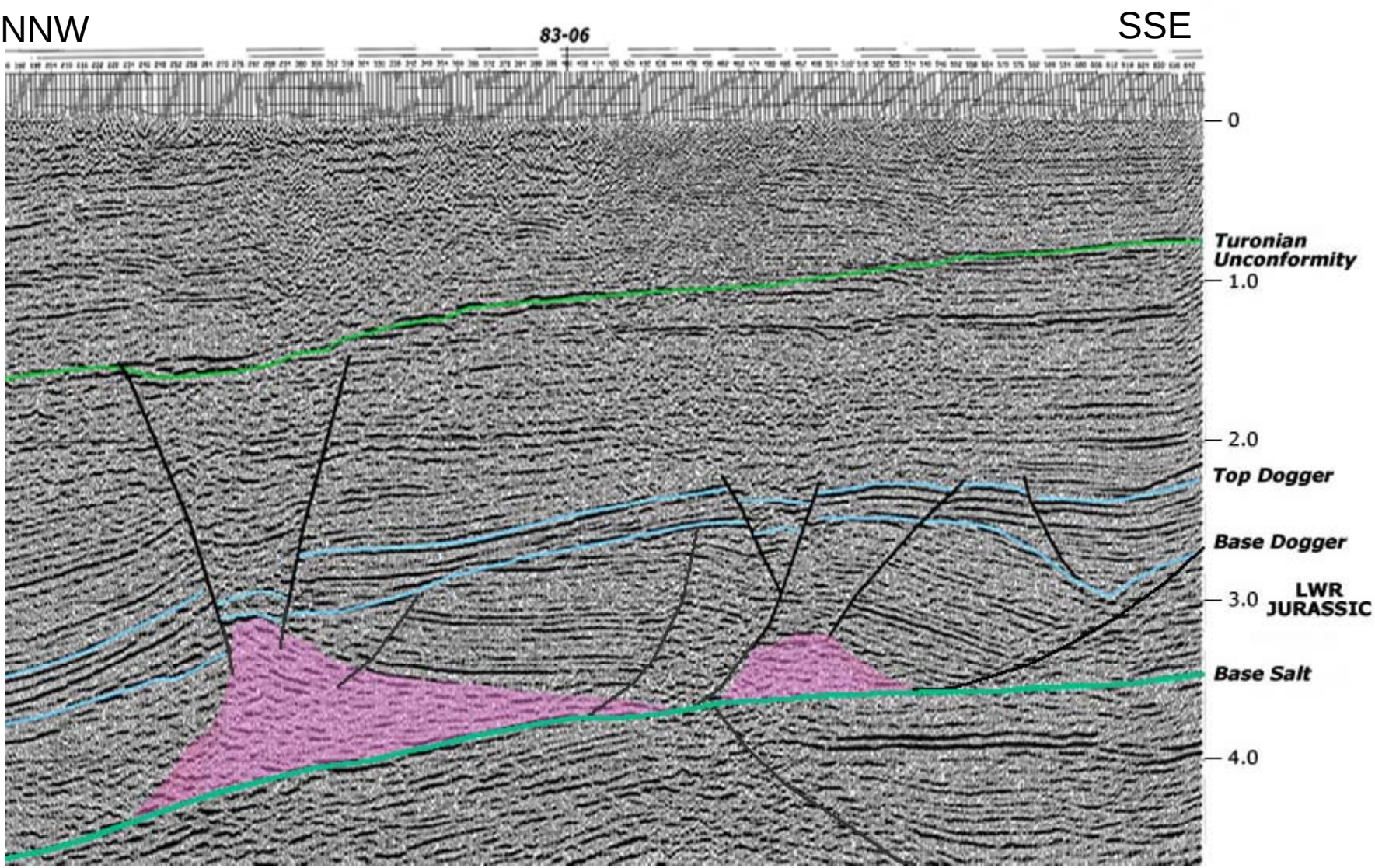
Seismic geometries suggest salt basin extends onshore



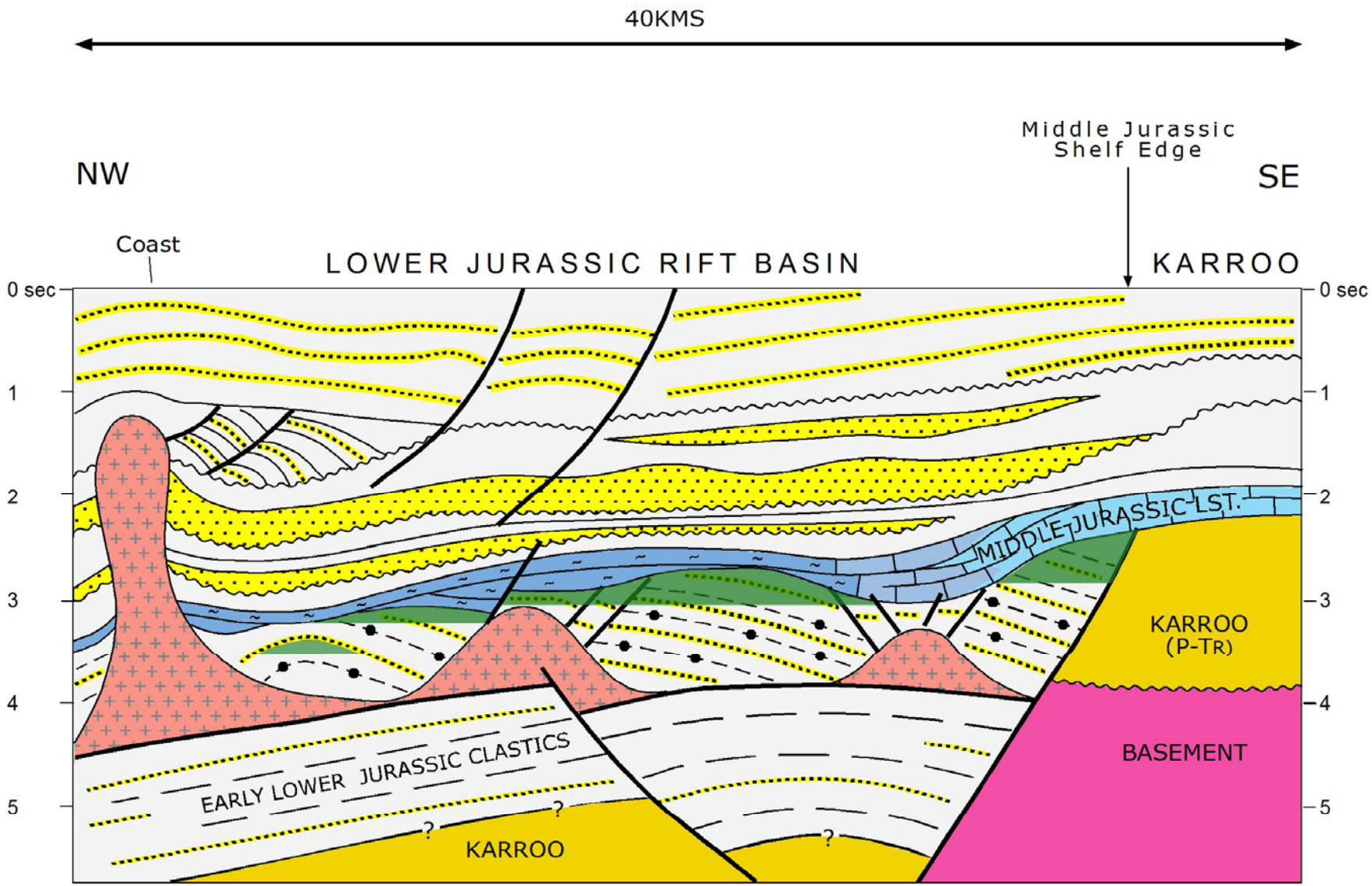
Adapted from Clark et al. (2002)

- Early salt movement & rim syncline development
- Salt movement largely finished prior to Base Dogger unconformity

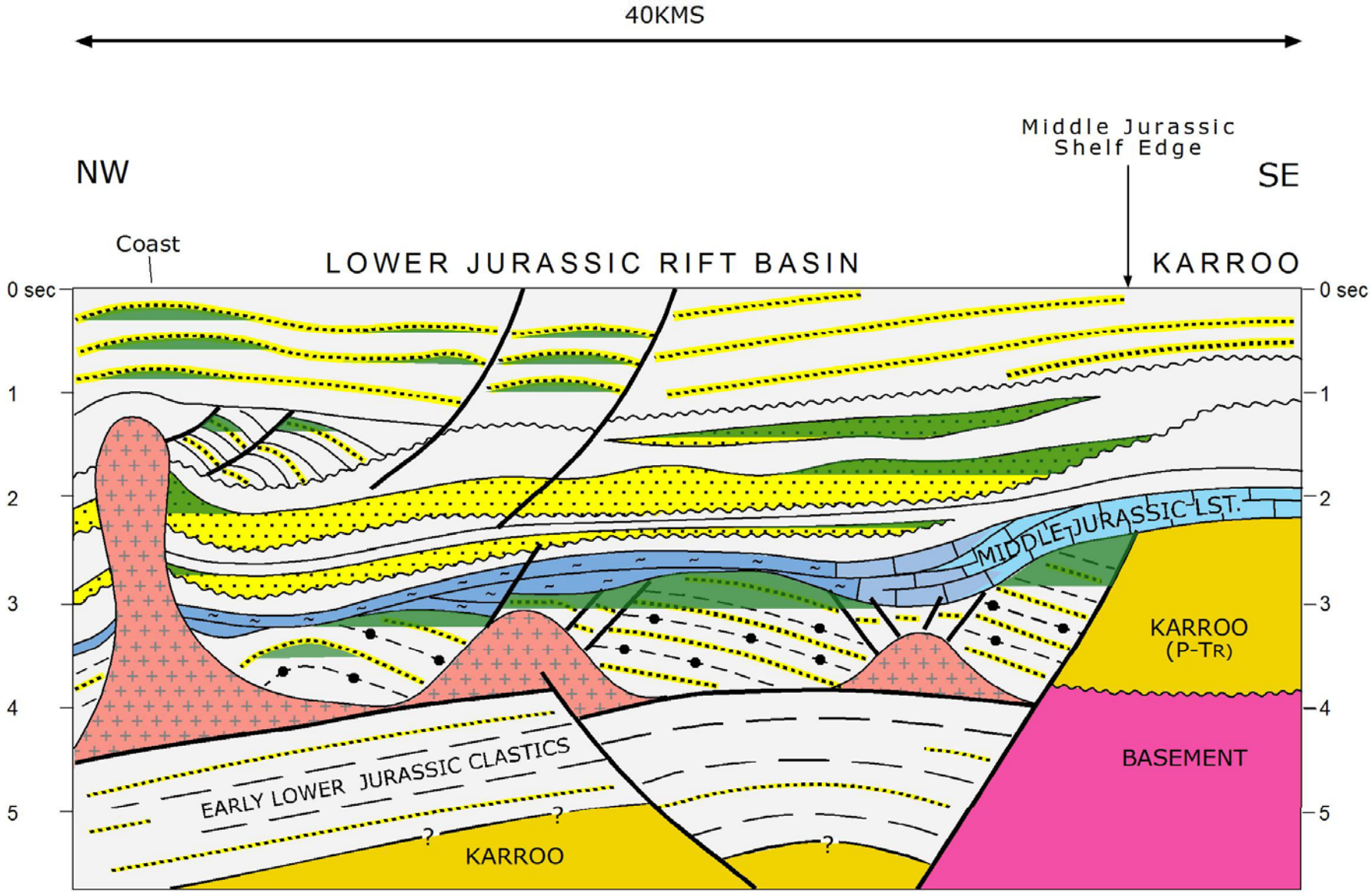
Large rim-syncline feature with unconformably overlying basinal facies of Dogger



Lower-Middle Jurassic onshore play concepts



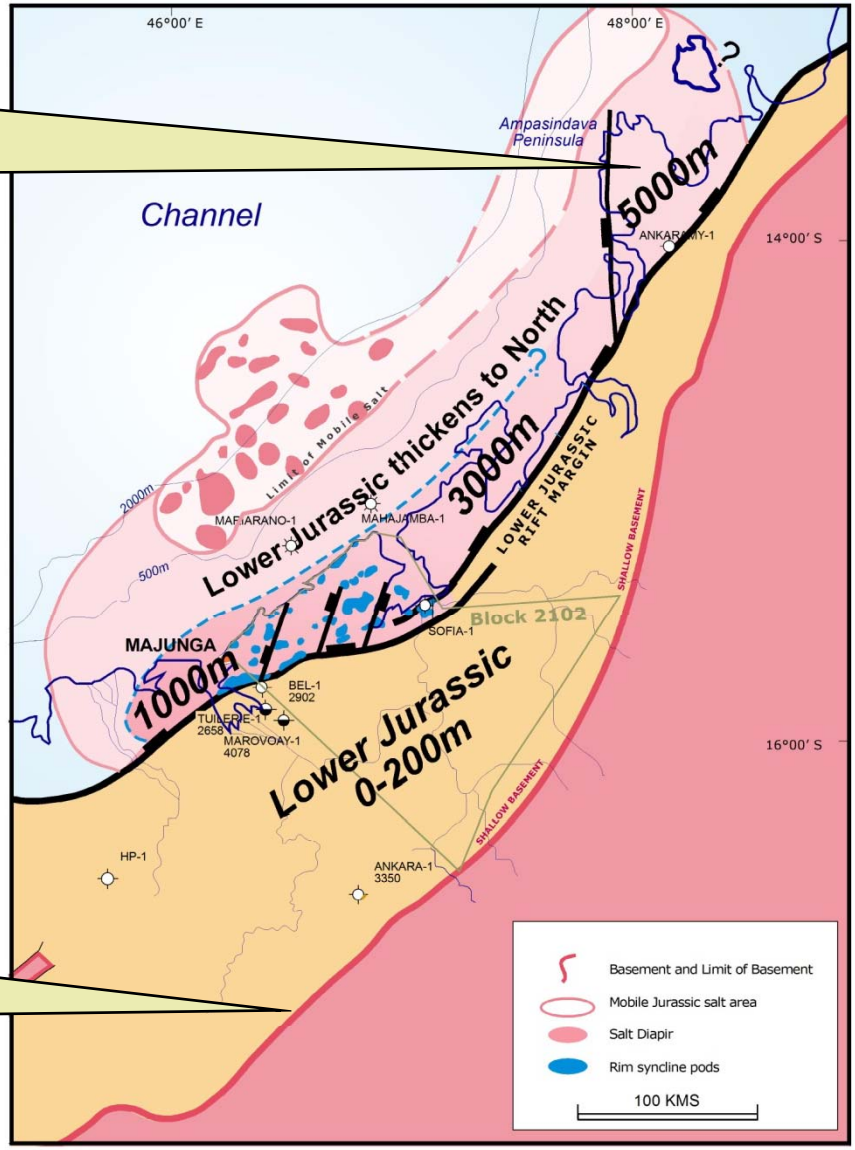
Lower-Middle Jurassic + overlying passive margin onshore play concepts



What's the evidence for a Lower-Middle Jurassic petroleum system?

Ampasindava Peninsula: 3000m+ Lower-Middle Jurassic source and oil-stained reservoir facies exposed on uplifted lateral equivalent of prognosed subsurface section to south

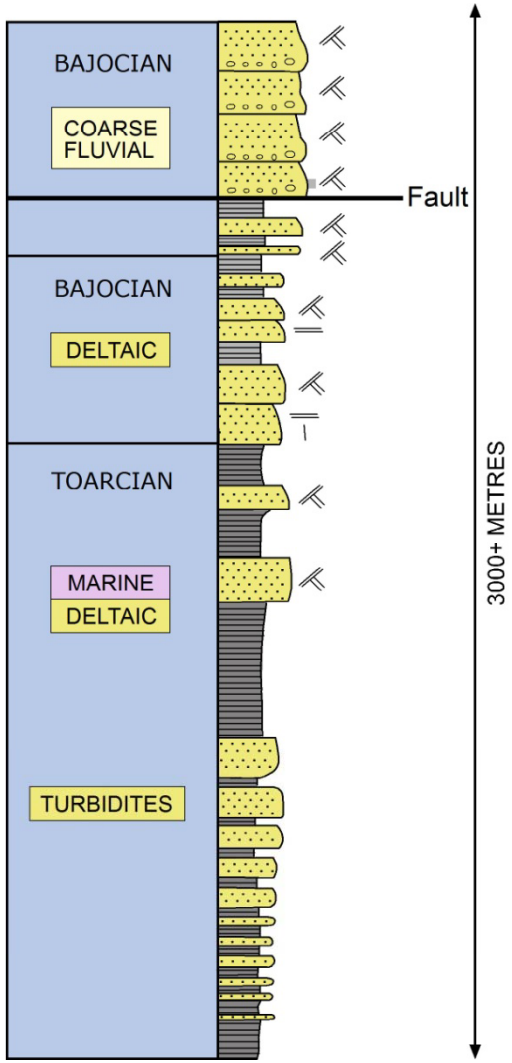
Ankaramy well had strong bitumen shows.

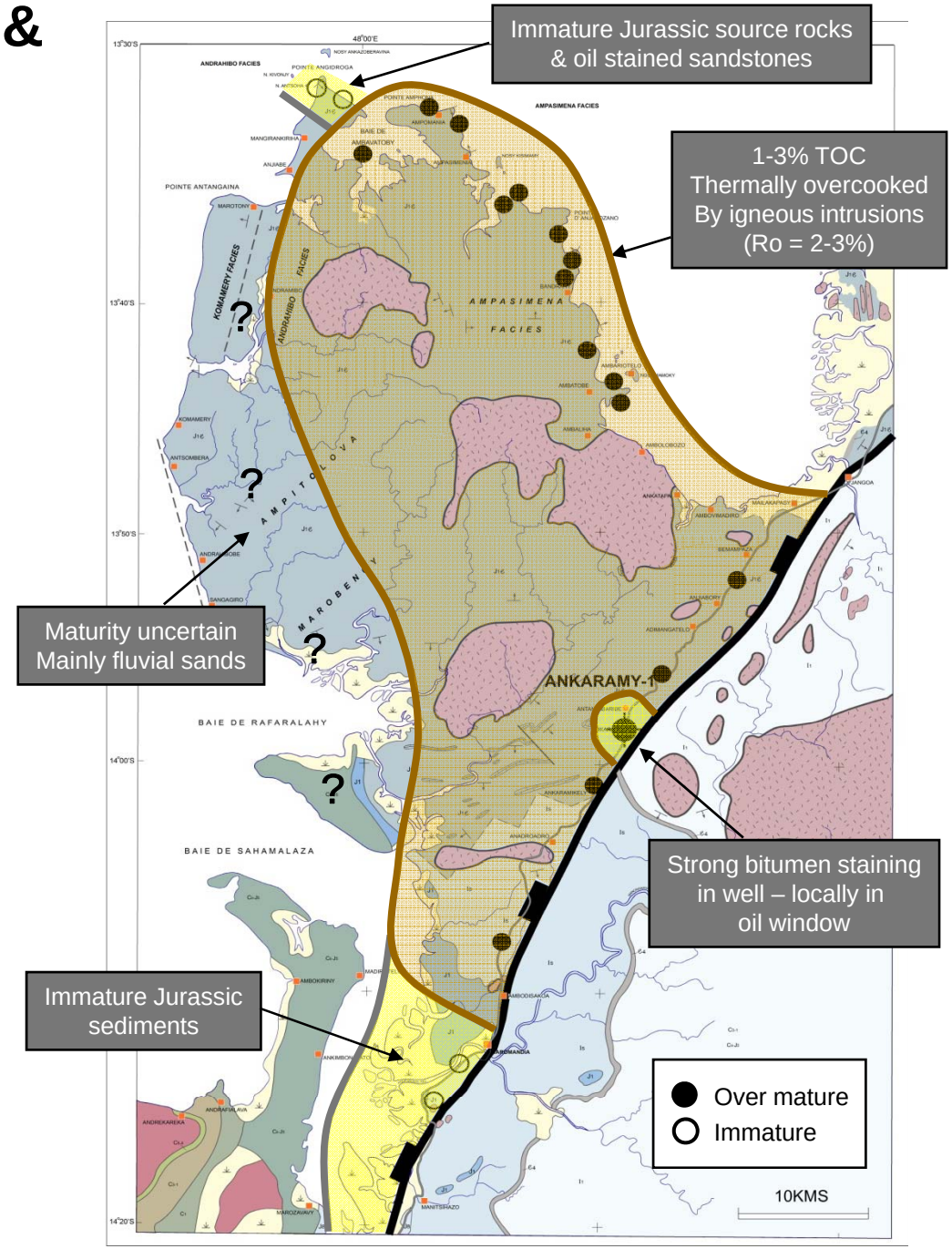


Beronono: Lower- Middle Jurassic source and reservoir facies exposed on basin margin: Bajocian Beronono shales & Aalenian sands

Ampasindava Peninsula: Toarcian large scale coarsening upward marine-deltaic parasequences

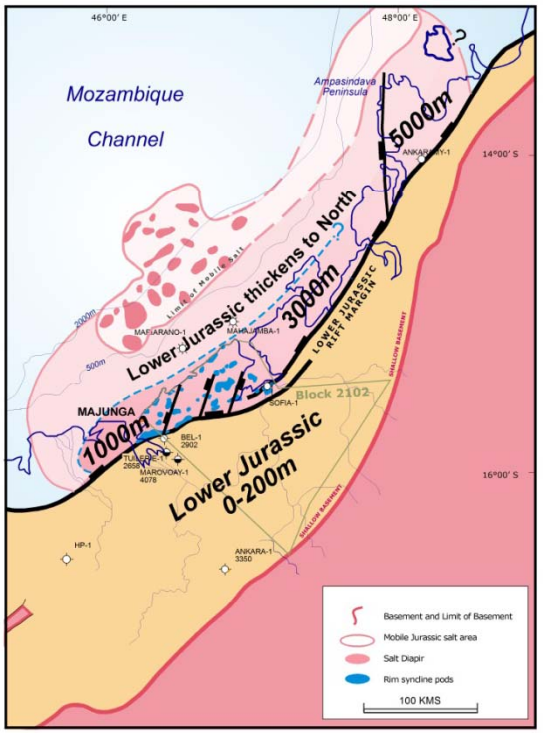
Ampasindava Peninsula & Ankaramy bitumen well

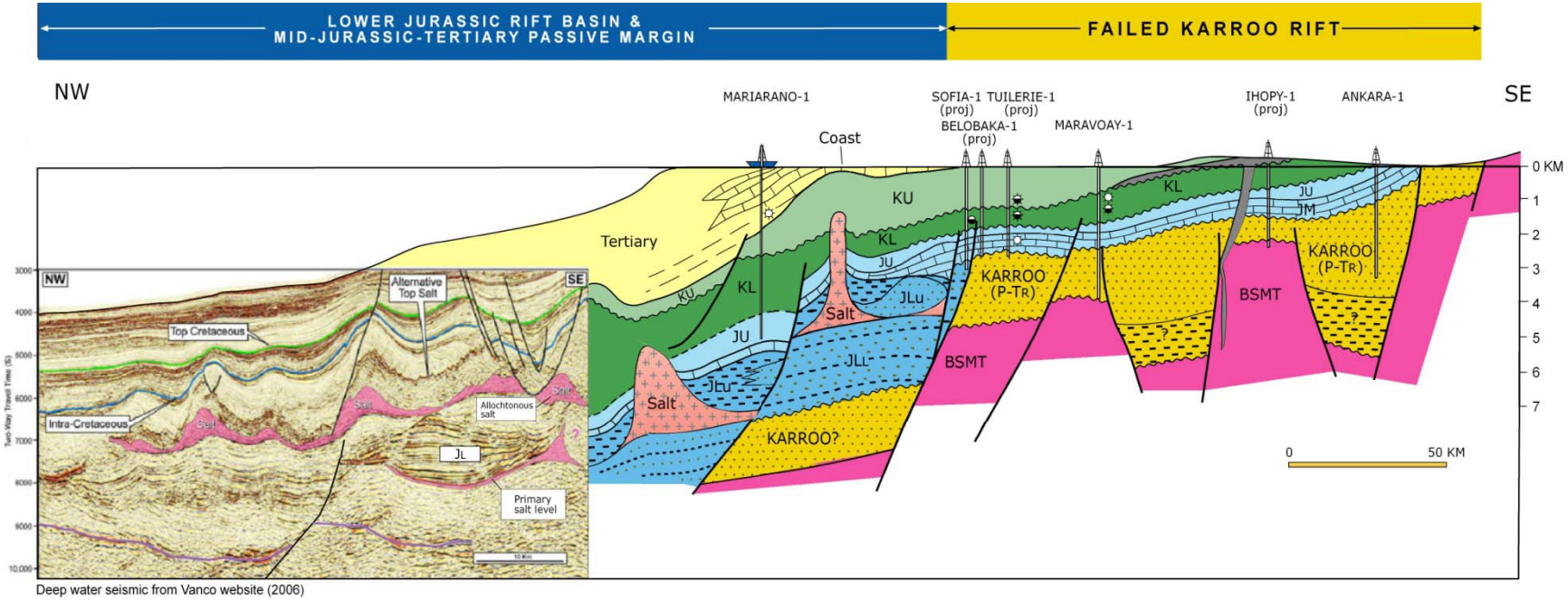




Implications for Madagascar's petroleum potential

- The oblique-rift Majunga Basin is seen as a very promising area for an untested Early Jurassic petroleum system
- Thick Early Jurassic rift section developed NW of major rift margin fault
- Multiple types of salt-related traps both offshore and onshore.
- Excellent source and reservoir potential from outcrop





Deep water seismic from Vanco website (2006)

References

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Reeves, C.V., B.K. Sahu, and M. de Wit, 2002, A re-examination of the paleo-position of Africa's eastern neighbours in Gondwana: Journal of African Earth Sciences, v. 34/1-4, p. 101-108.

Vanco Energy website: http://www.vancoenergy.com