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Source Maturity and Petroleum Generation in the Dahomey Basin SW Nigeria: Insights from Geologic and Geochemical Modelling.

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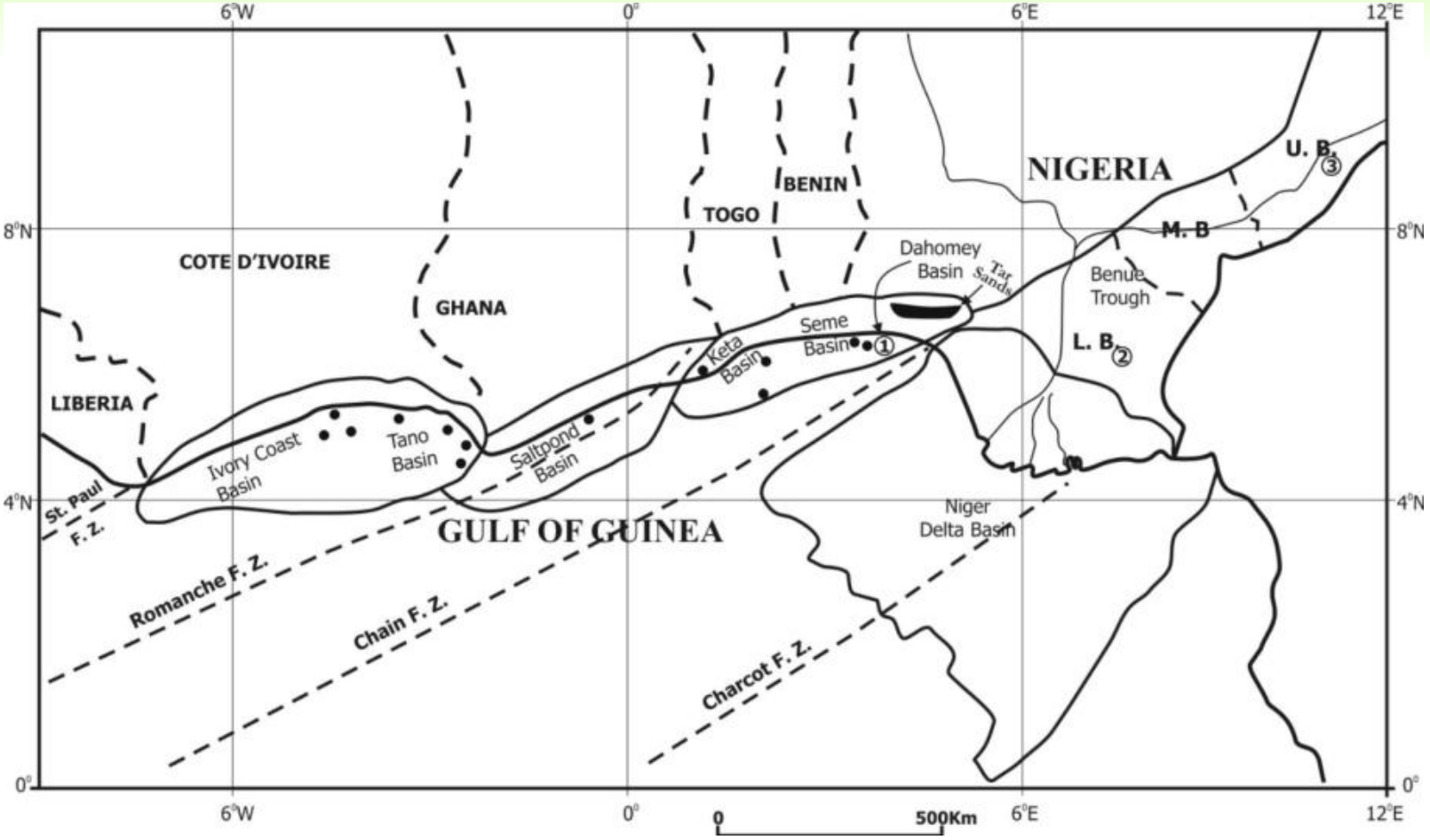
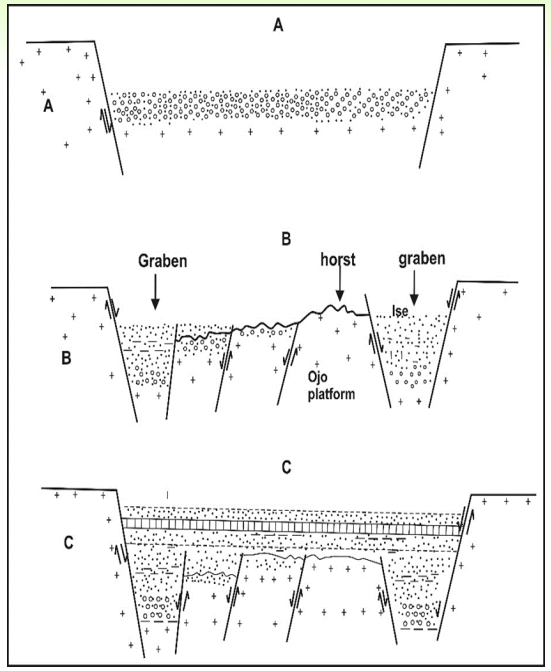
Talk Outline

- Introduction
- Aim and Objectives of the Study
- Basin Setting
- Methodology
- Results and Interpretations
- Conclusions

Introduction- Tectonic Settings and Evolution History of Dahomey Basin



(fter Brownfield and Charpentier, 2006)



(Modified after Omatsola and Adegoke, 1981)

Stratigraphic Settings of Dahomey Basin

AGE		FORMATION	
QUART.	PLEISTOCENE	BENIN Fm	
TERTIARY	EOCENE	ILARO Fm	
		OSHOSUN Fm	
	PALEOCENE	EWEKORO Fm	
CRETACEOUS	CAMPANIAN - MAASTRICHTIAN	ABEOKUTA GROUP	ARAROMI Fm
	TURONIAN-CONIACIAN		AFOWO Fm
	BARREMIAN - CENOMANIAN		ISE Fm

(After Omatsola and Adegoke, 1981)

Aim and Objectives of the Study

Aim:

To investigate Cretaceous sediments from selected deep wells and shallow boreholes in the Dahomey Basin for possible potential petroleum system source rocks.

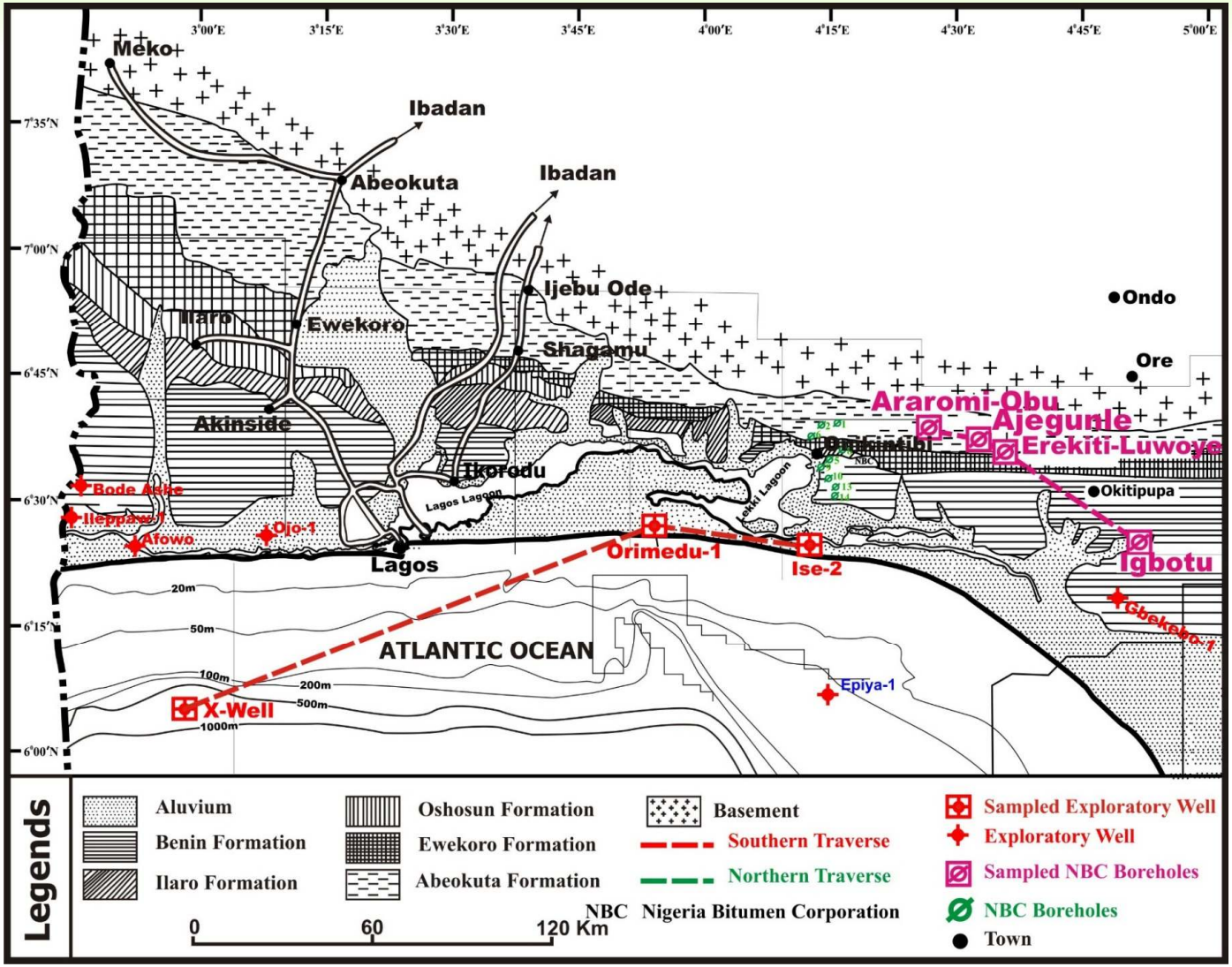
Objectives:

- ❑ **Evaluate the thickness, properties and distribution of the potential source rock types**
- ❑ **Characterize the potential source rocks**
- ❑ **Determine the stratigraphic positions of the source rocks**
- ❑ **Construct a thermal history and generation potentials model of the source rock(s),**

Research Methodology

- ❑ Field Data gathering
- ❑ Laboratory Studies
  - ✓ Foraminifera Biostratigraphy
  - ✓ Geochemical Studies
- ❑ Thermal History Modelling

Location of the Investigated Exploratory Wells and Boreholes

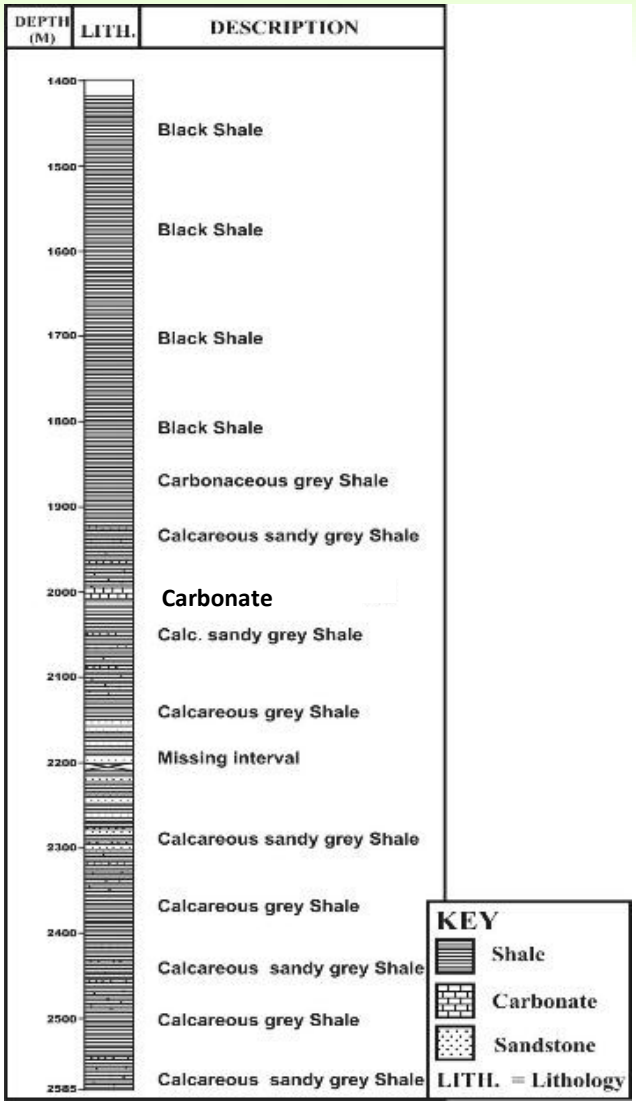


Geological map of the Dahomey Basin

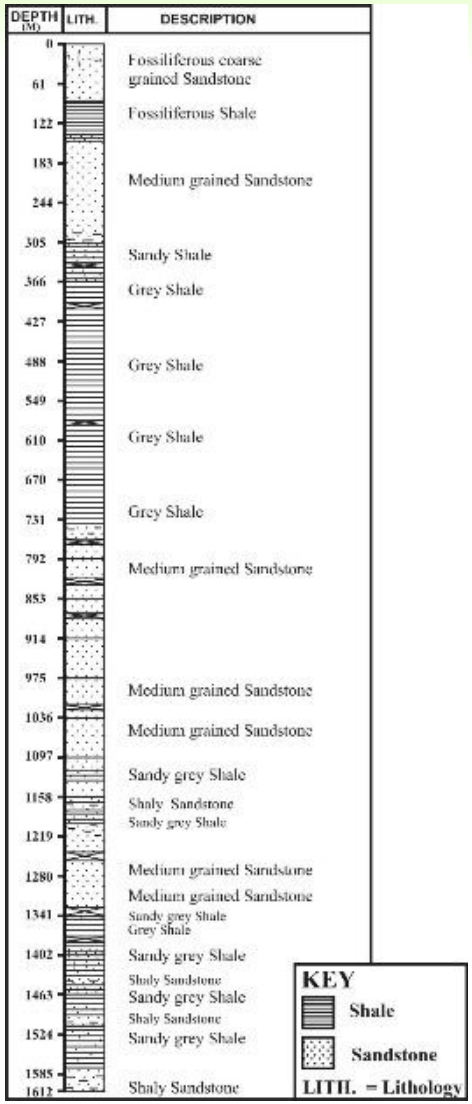
Modified after Adekeye (2005)

Lithostratigraphy- Southern Traverse Exploratory wells

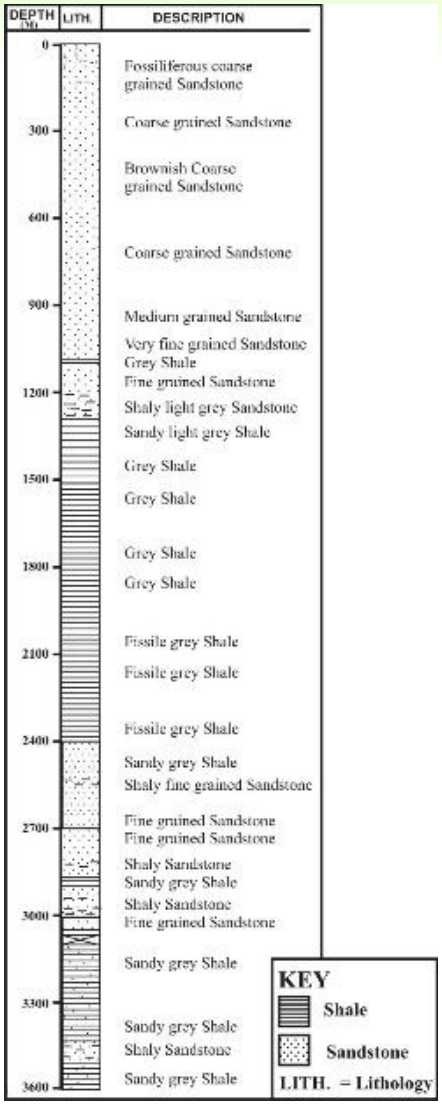
X



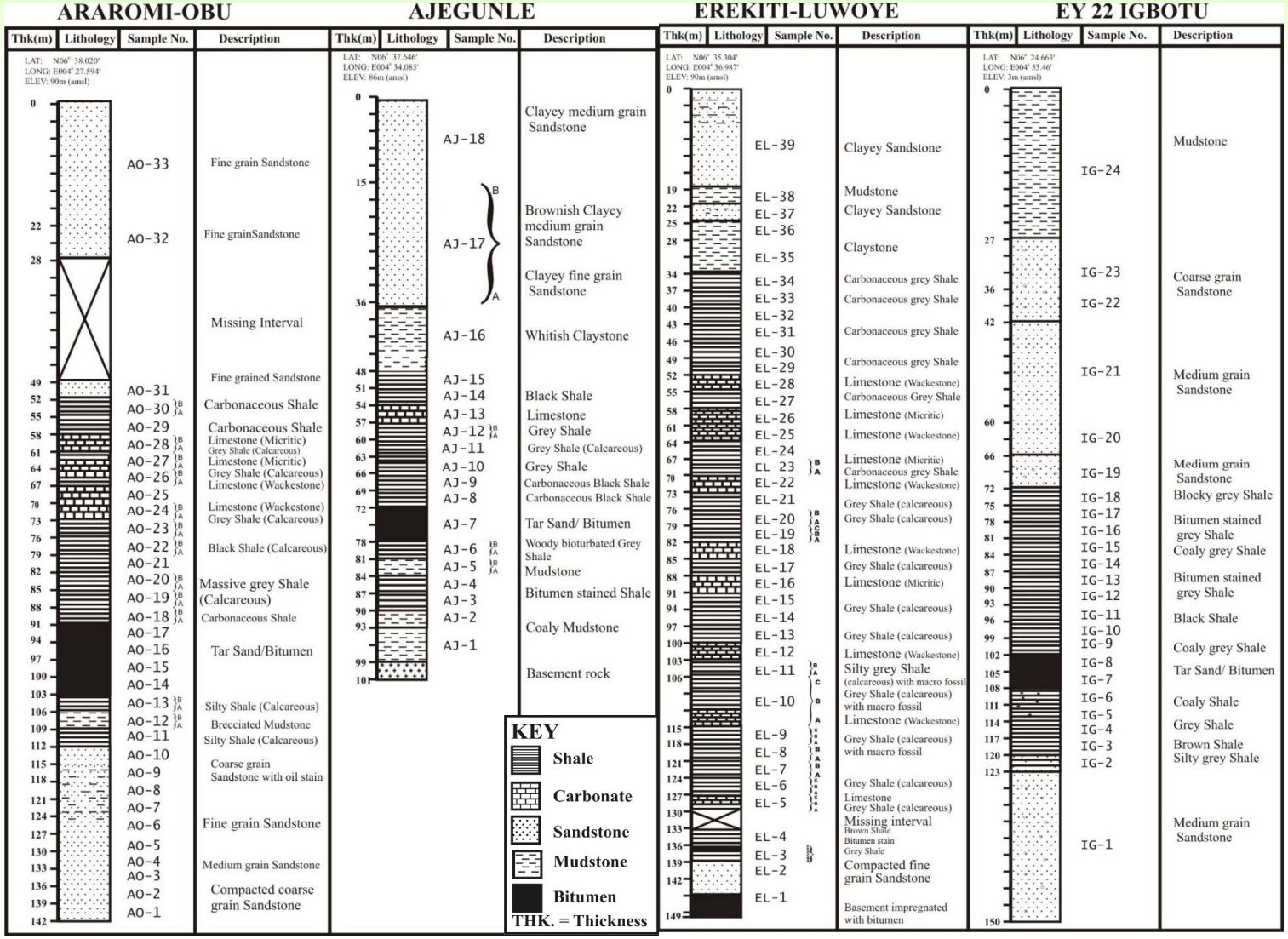
ORIMEDU-1



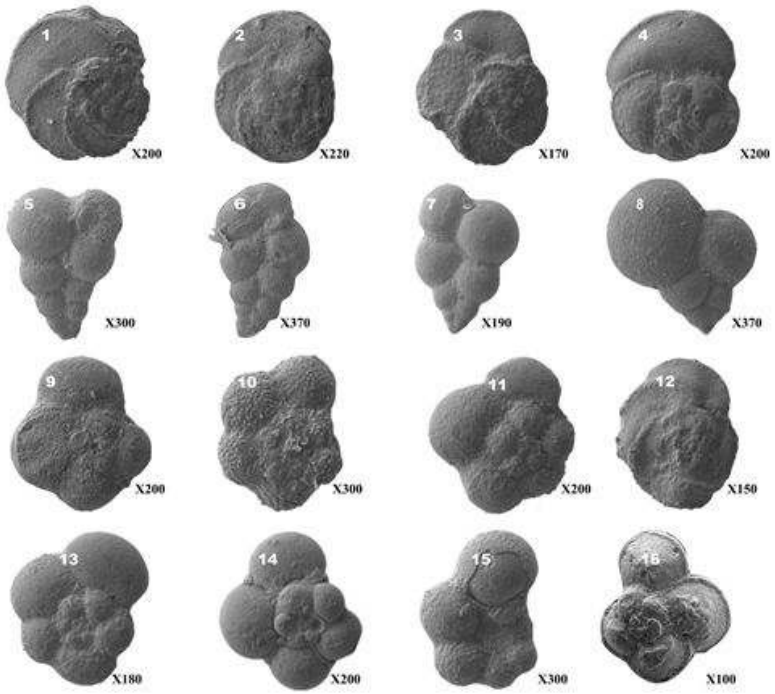
ISE-2



Lithostratigraphy- Northern Traverse Boreholes

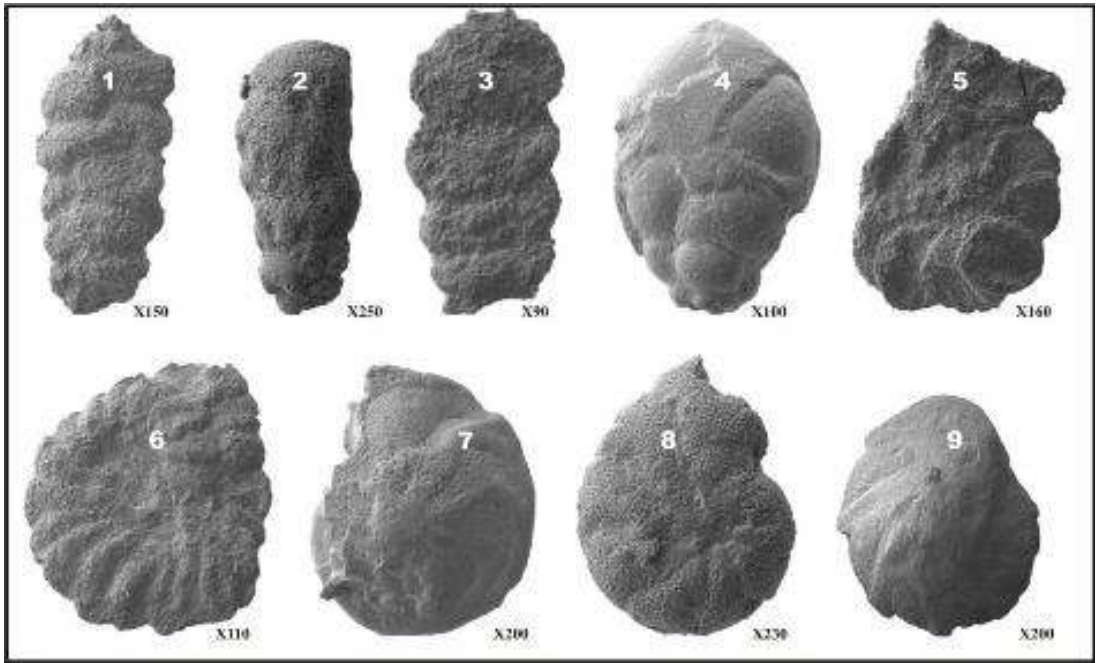


Recovered Planktonic and Benthic foraminifera Species



1. Rotalipora greenhenoensis, 2. Marginotruncana cf., pseudolinneiana 3. Dicarinella primitiva, 4. Whiteinella inornata, 5. Heterohelix moremani, 6. Heterohelix pulchra, 7. Heterohelix globulosa, 8. Heterohelix reussi, 9. Praeglobotruncana stephani, 10. Globotruncana sp., 11. Whiteinella archaeocretacea, 12. Marginotruncana cf. renzi, 13. Whiteinella baltica, 14 Hedbergella delrioensis, 15. Hedbergella simplex, 16. Rotalipora cushmani

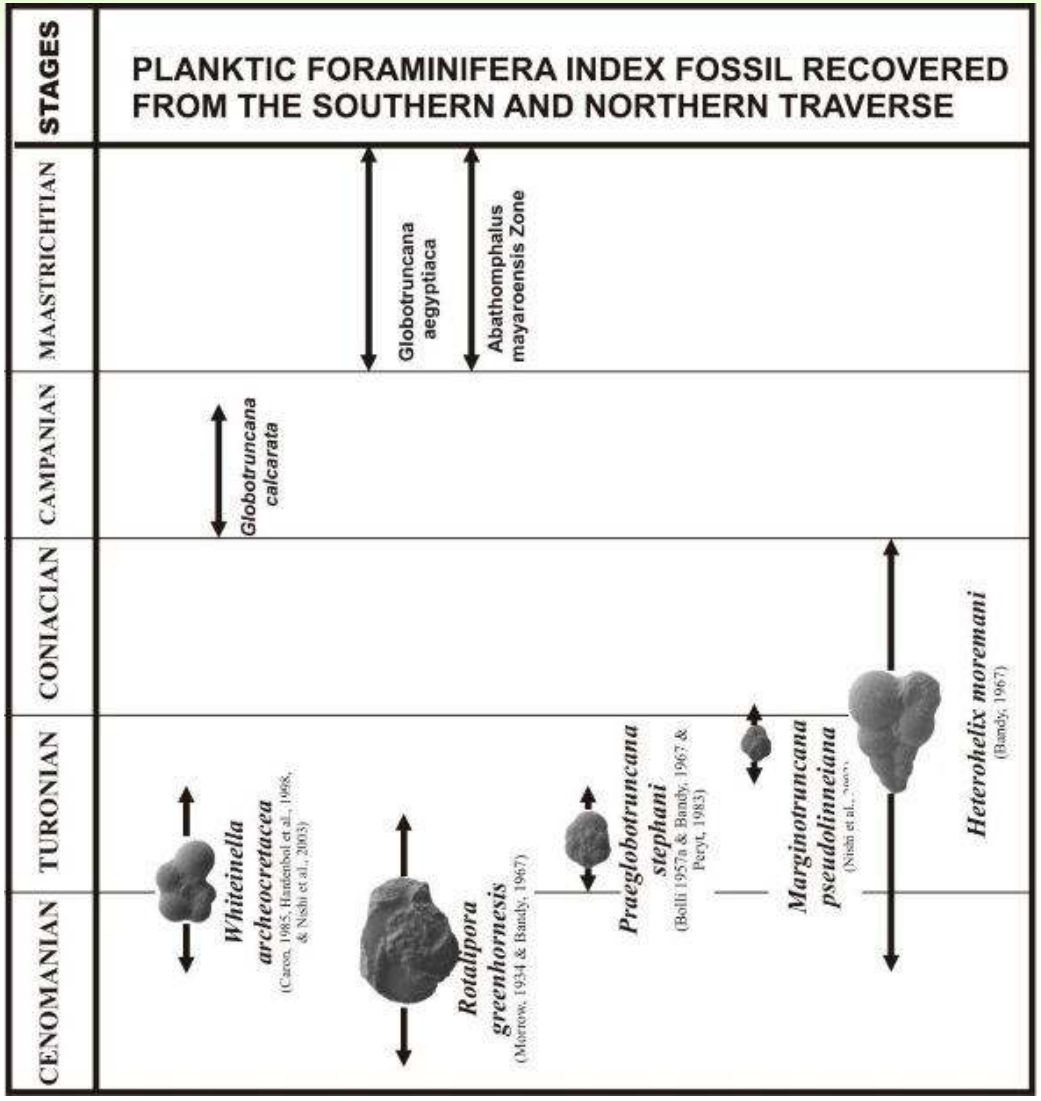
Planktonic Species



1. Textularia, 2. Afrobolivina, 3. Reophax, 4. Gabotina, 5. Ammobaculites, 6. Haplophragmoides, 7. Planulina, 8. Gavelina, 9. Lenticulina

Benthic Species

Index Fossil for Biostratigraphy Zonation



Morrow, 1934,

Bolli, 1957a

Bandy, 1967

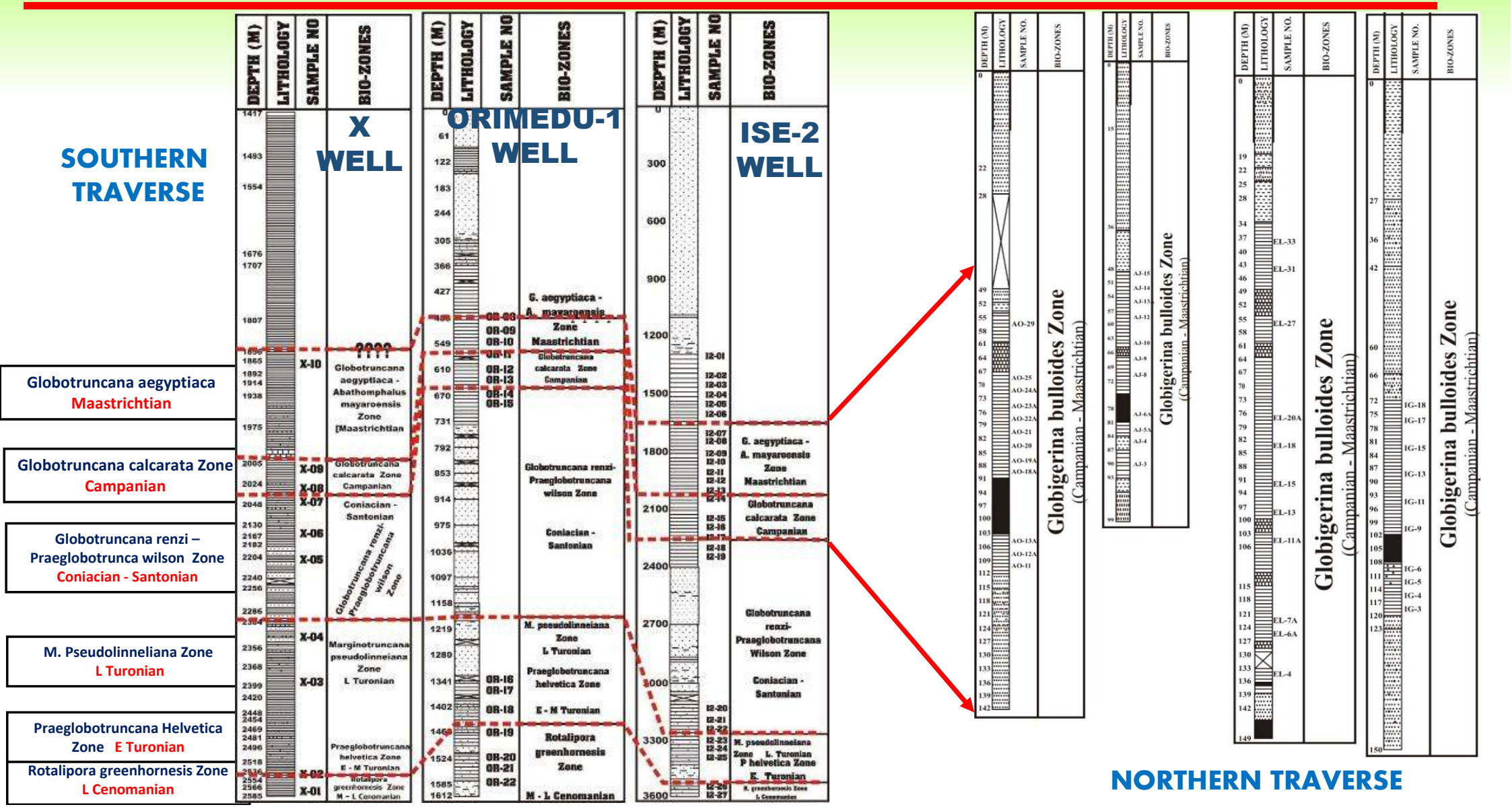
Peryt, 1983

Caron, 1985

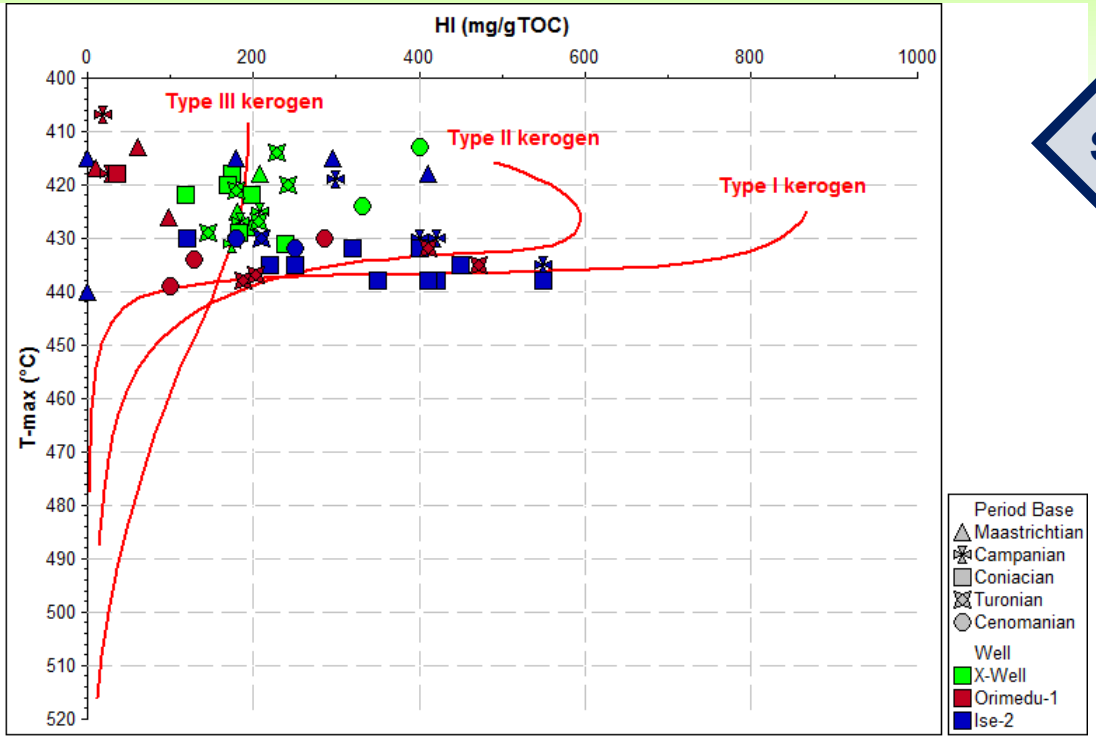
Hardenbol et al 1998 and

Nishi et al., 2003,

Biostratigraphic Zonation

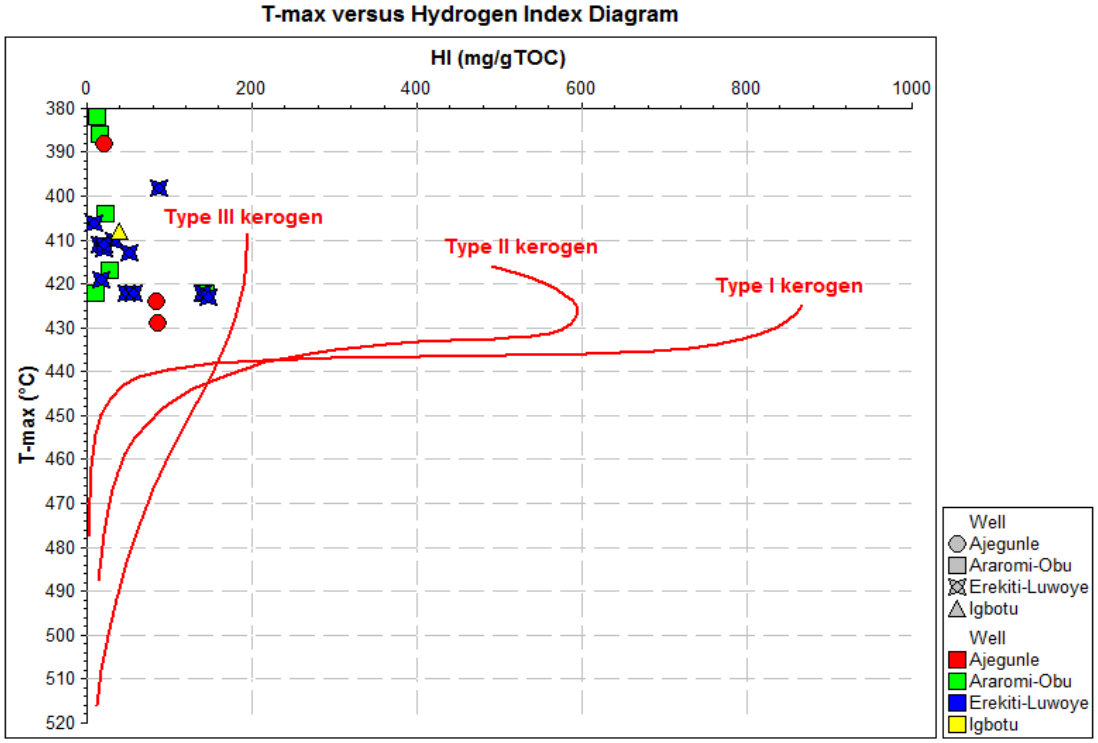


Kerogen Type on HI/Tmax Plots

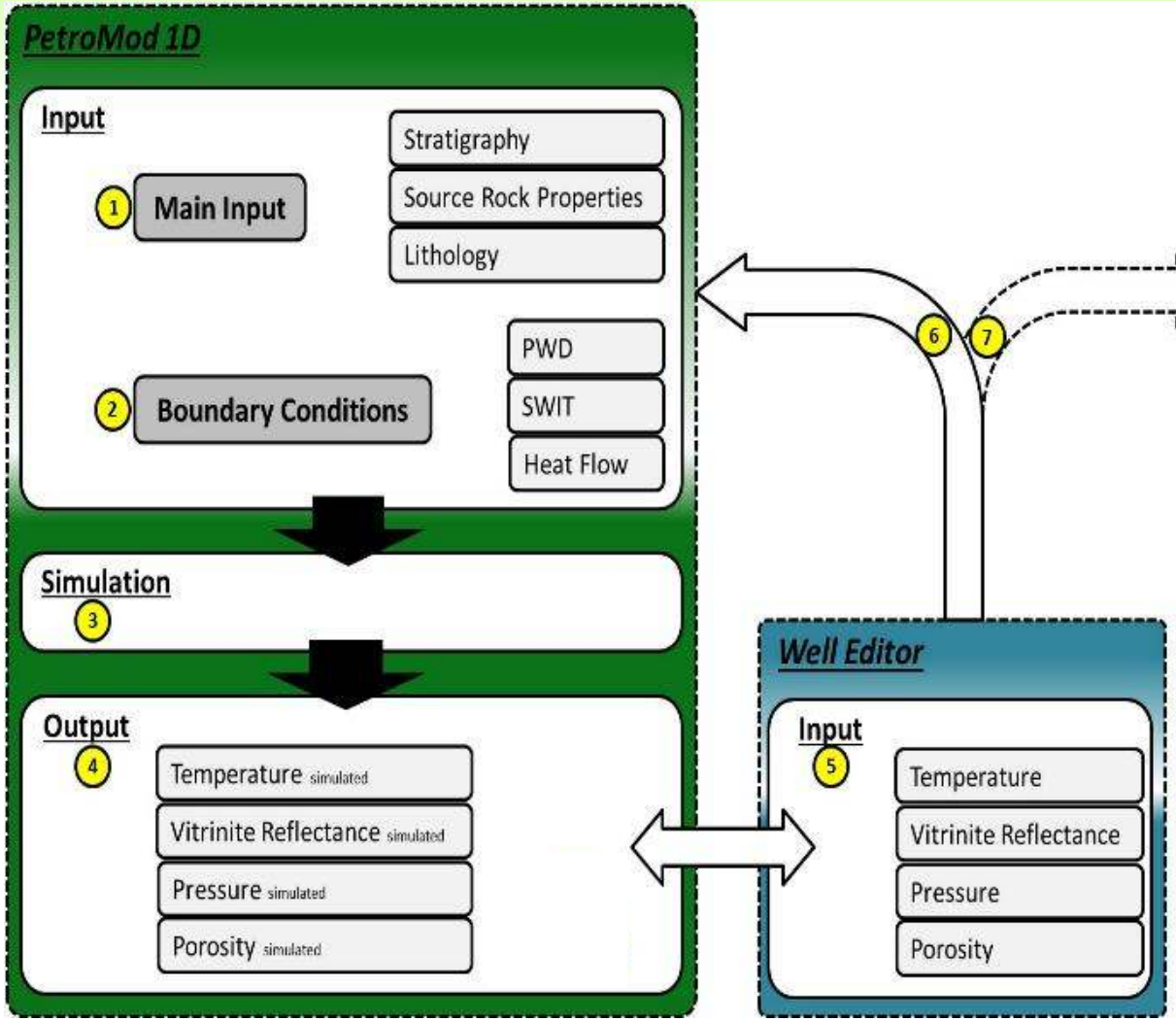


Southern Traverse Deep wells

Northern Traverse Shallow BH



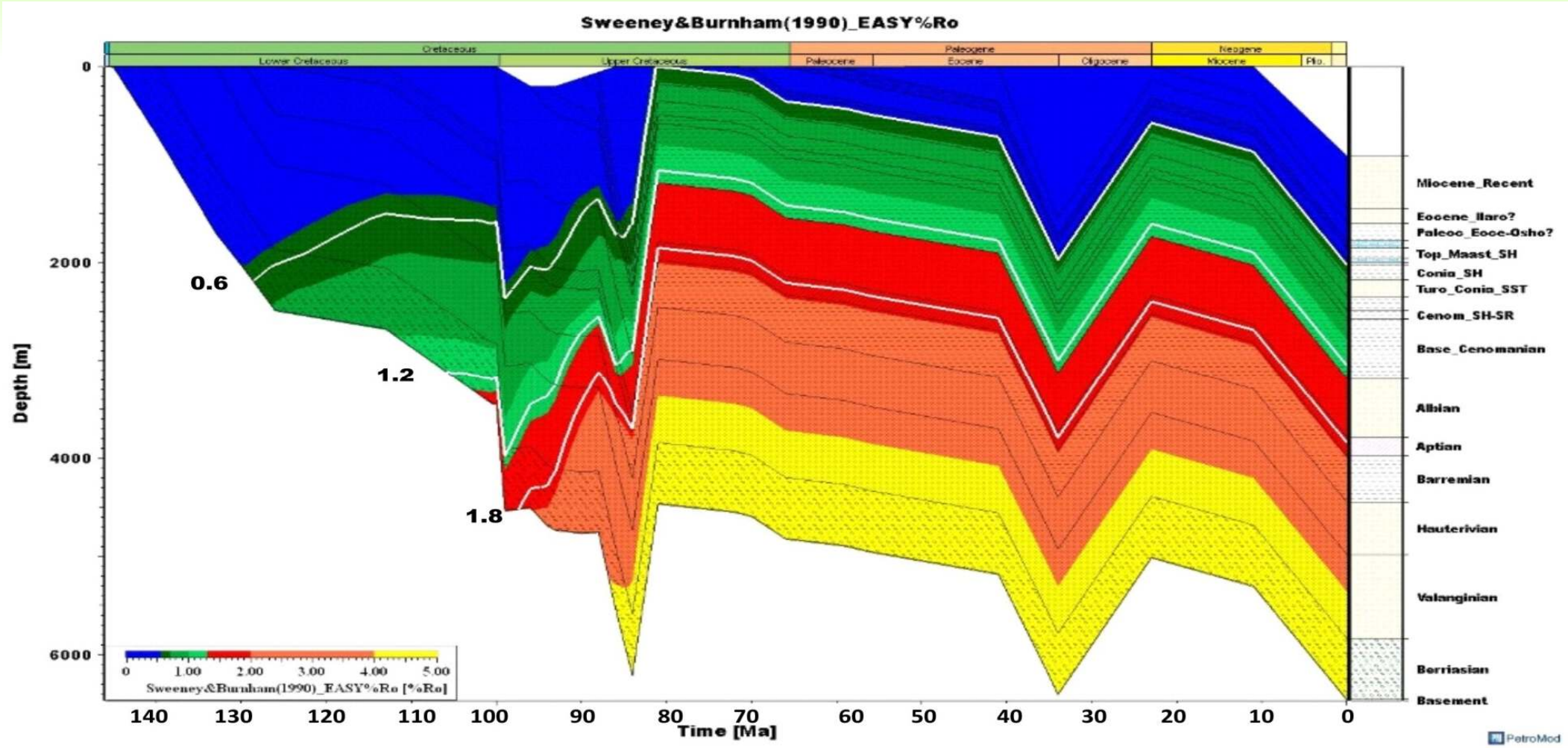
Burial History and Generation Potential Modelling



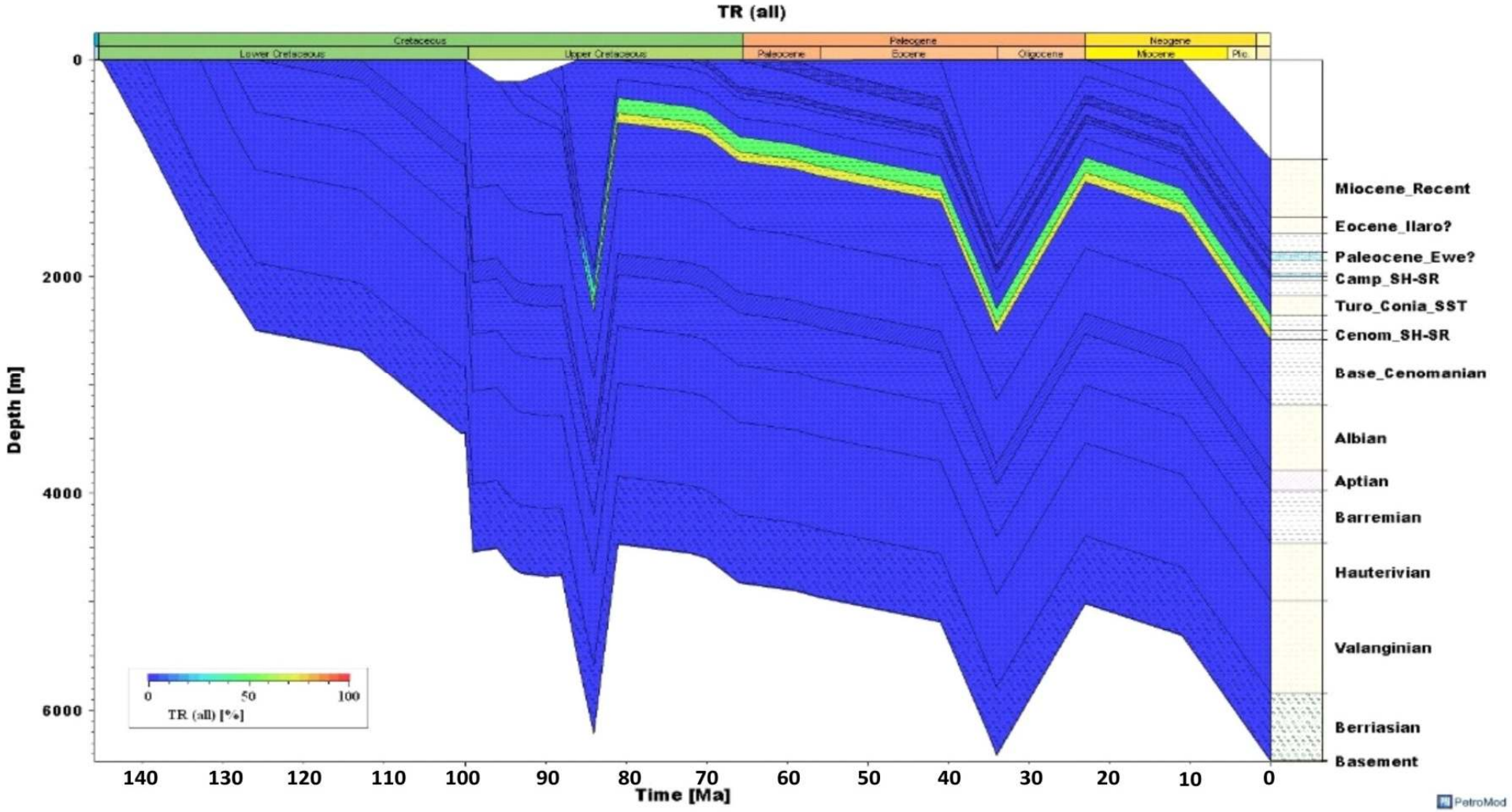
If the output data matches the calibration, the modeling process is complete; your model is well calibrated

PetroMod 1D Modelling Workflow

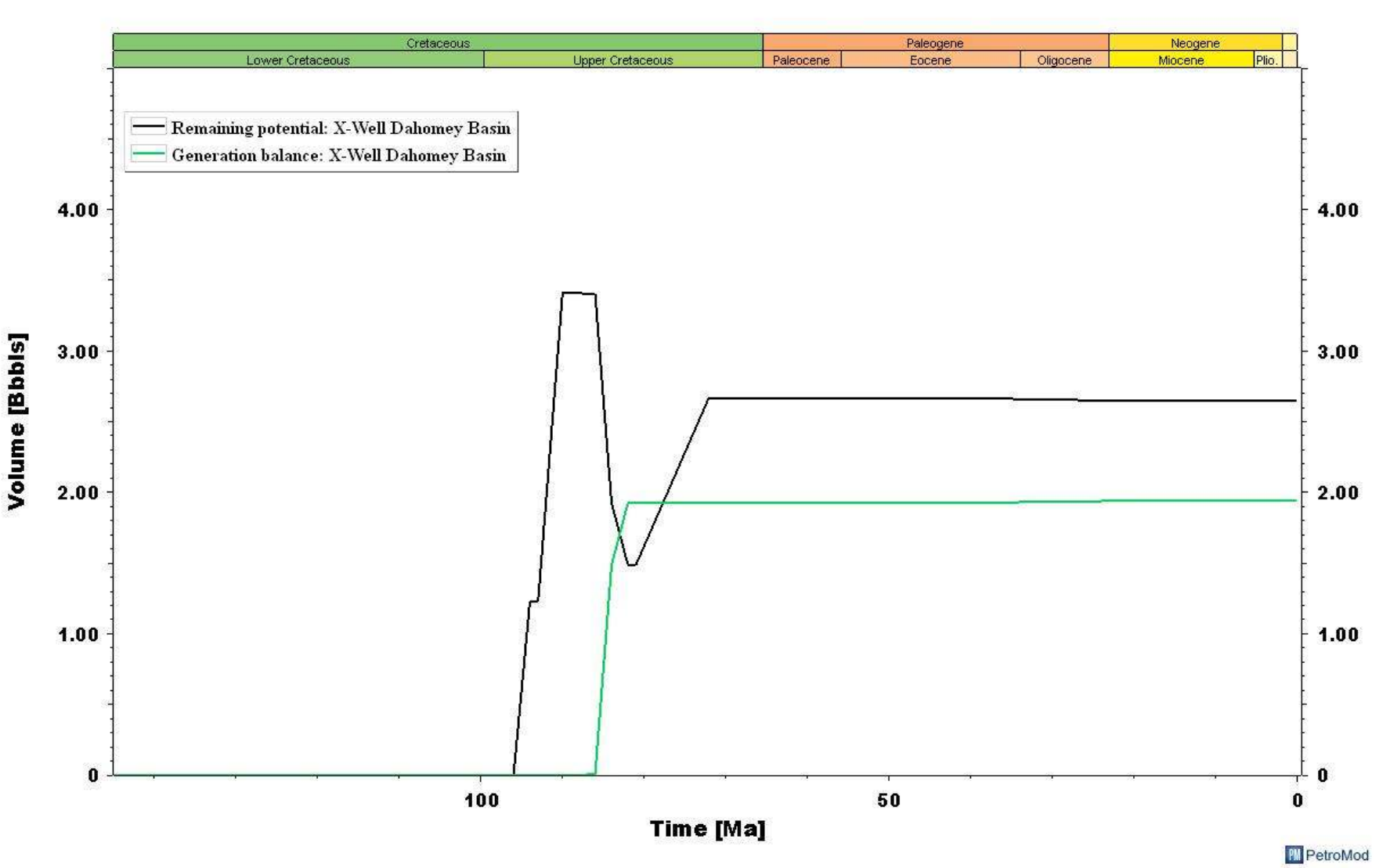
Burial and Thermal History for the Offshore X Well, Dahomey Basin



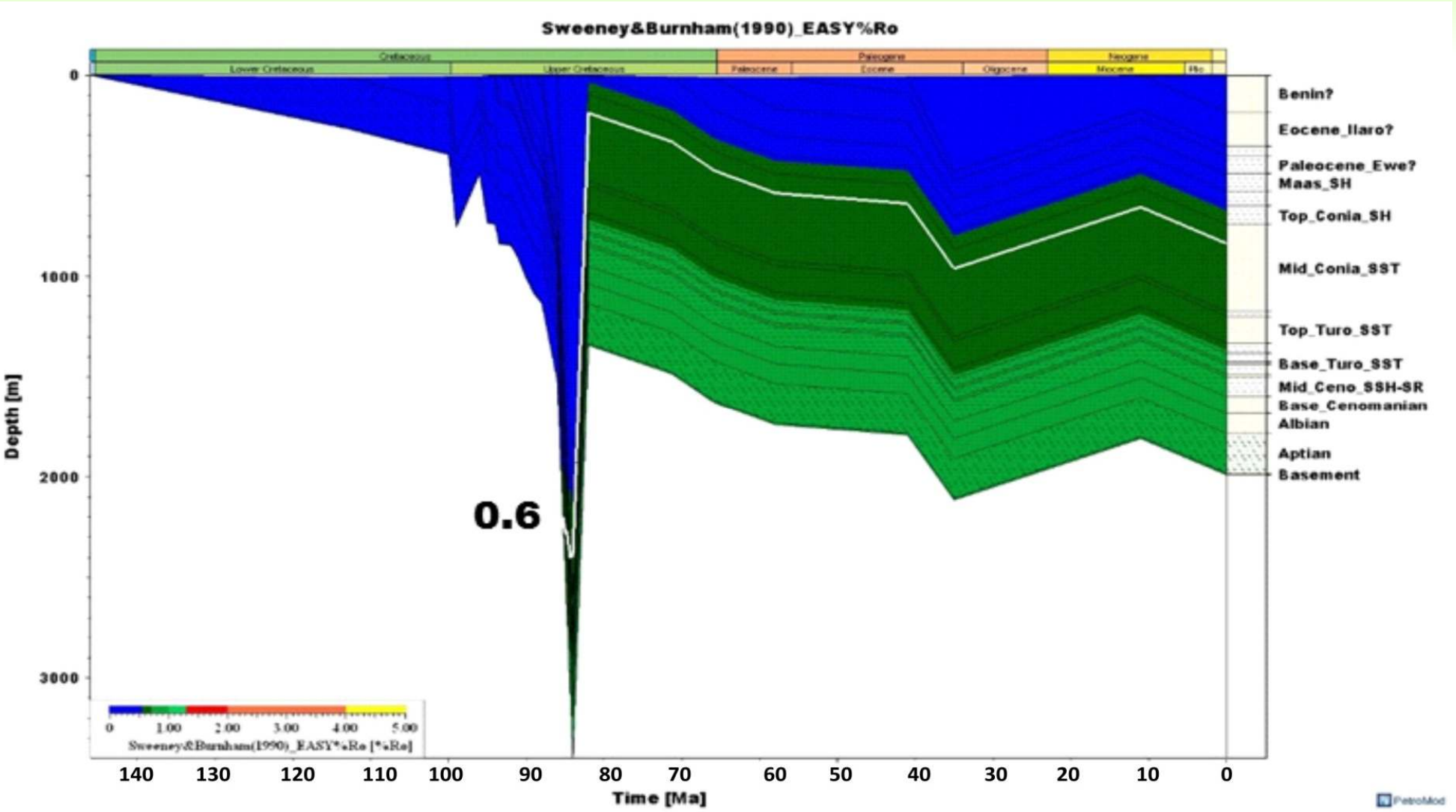
Transformation History of the X well



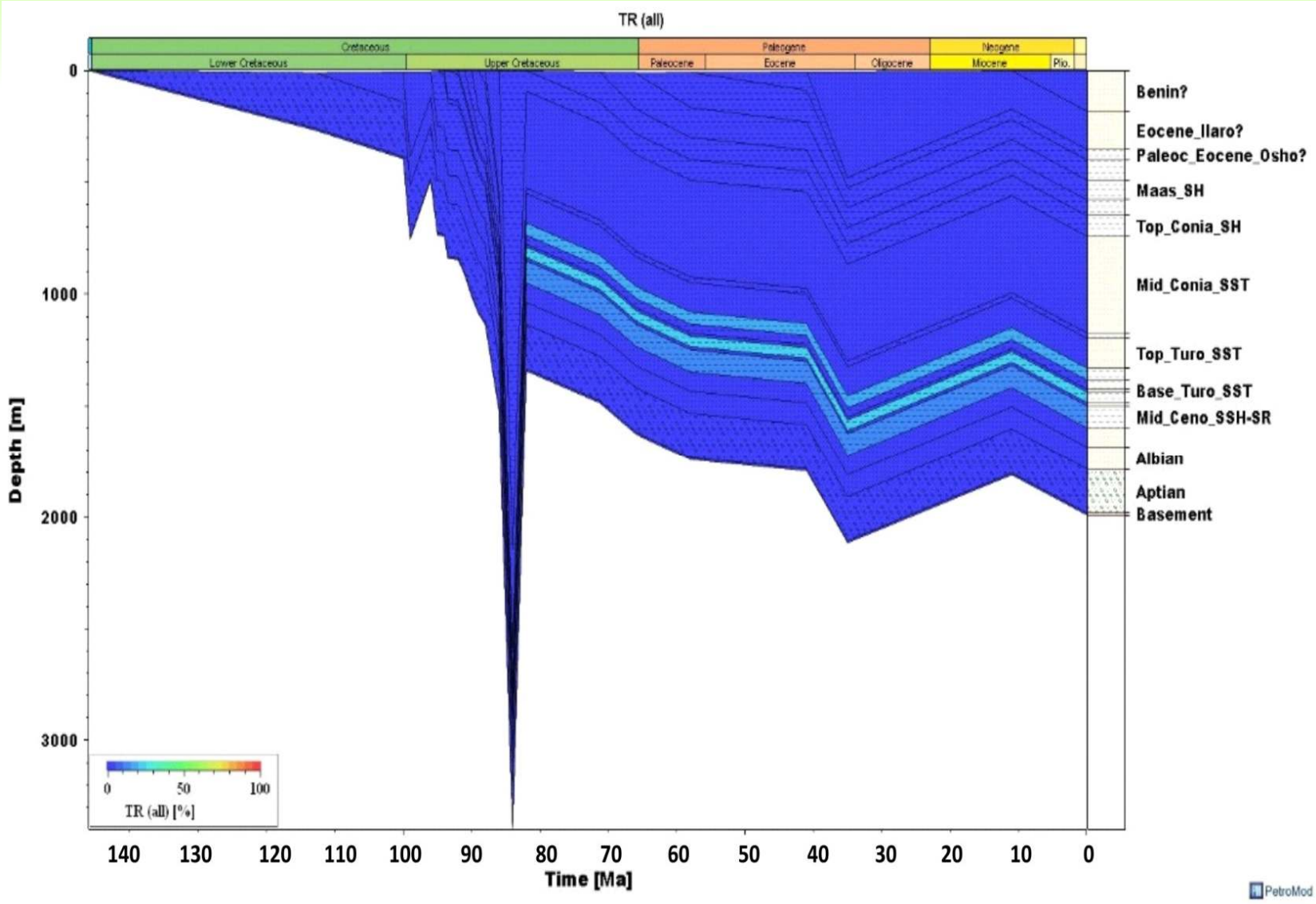
Generated and Remaining Potential in the X well



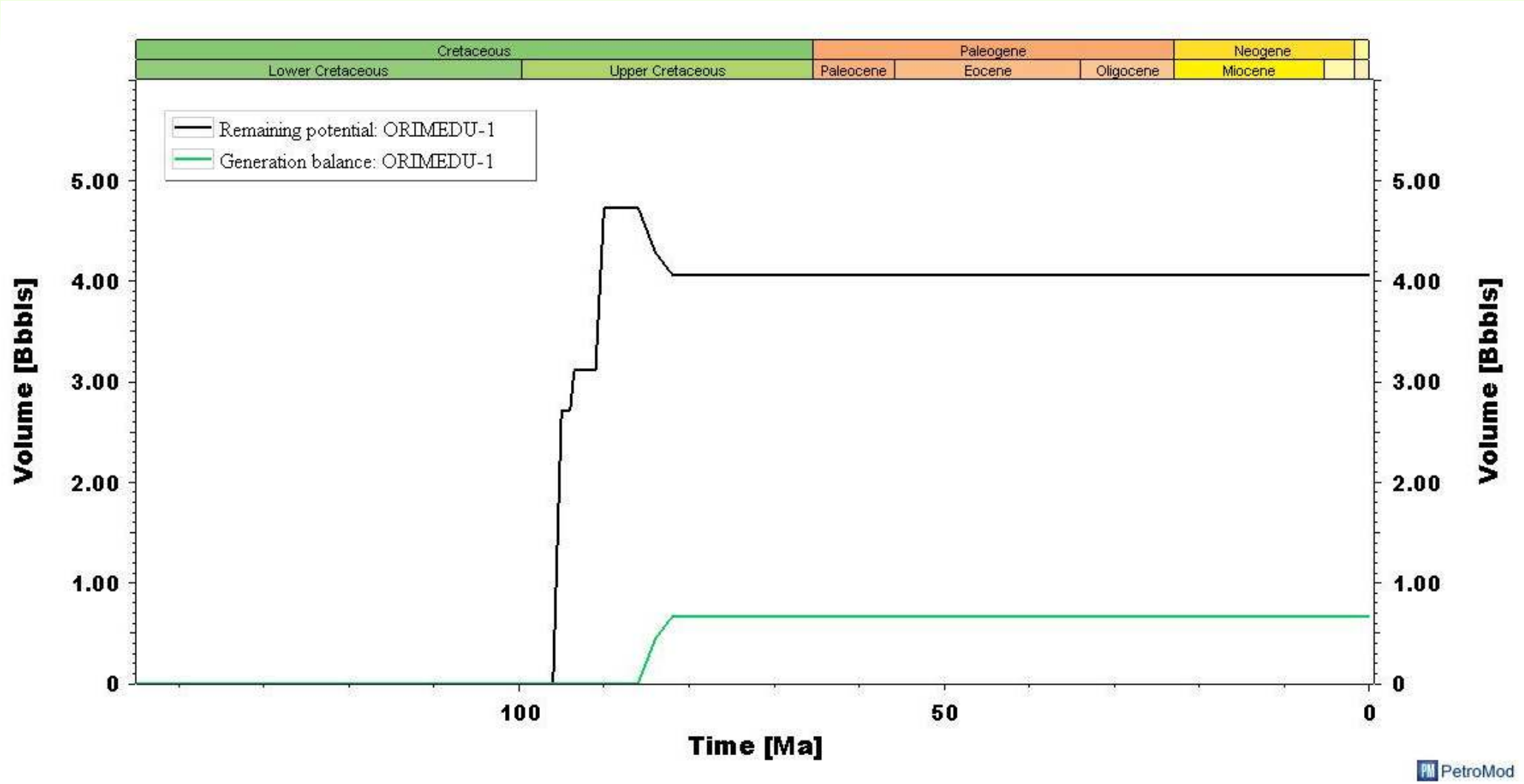
Burial and Thermal History of the Orimedu-1 Well



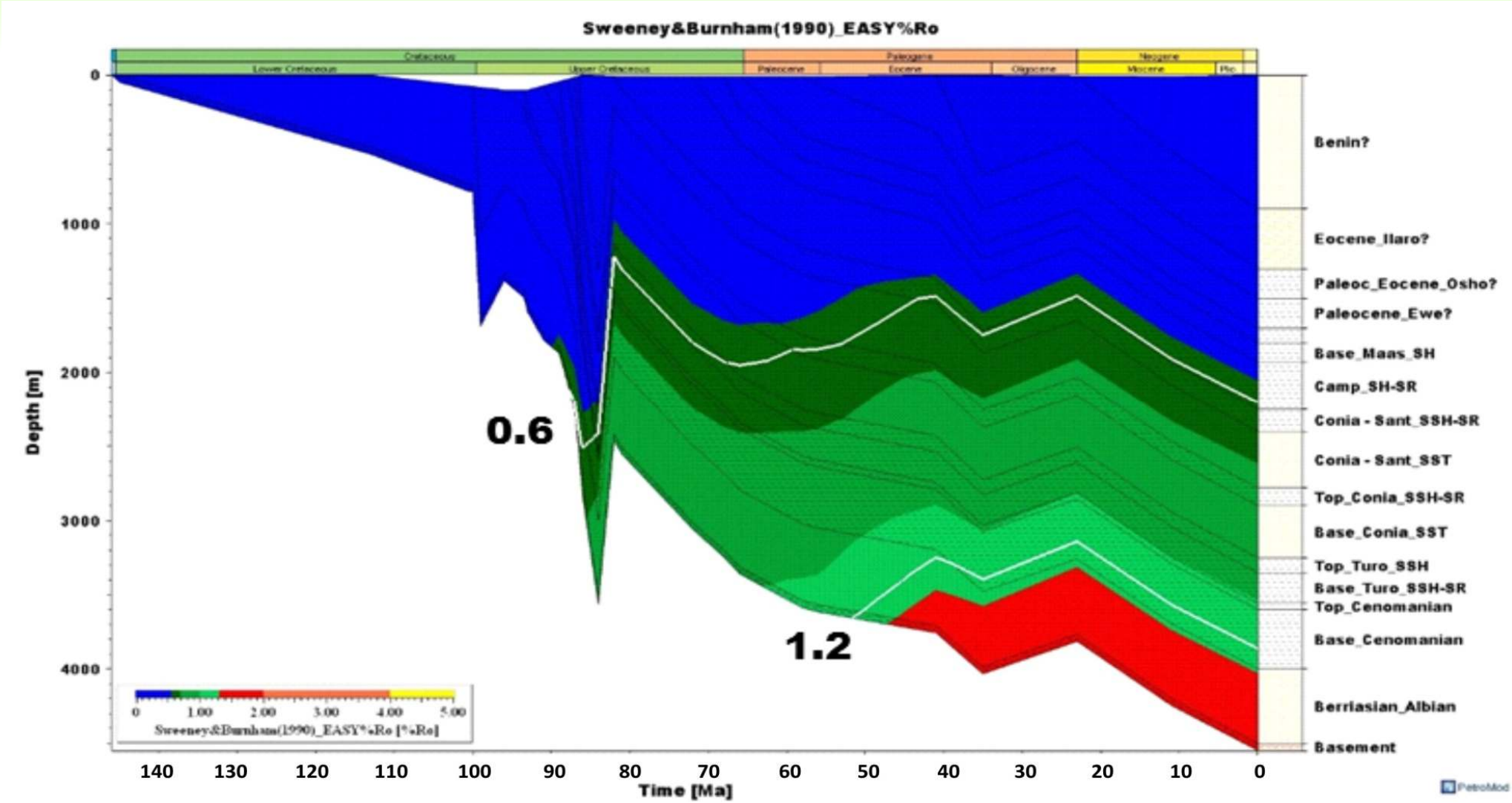
Transformation History of the Potential Source Rock in Orimedu-1 Well



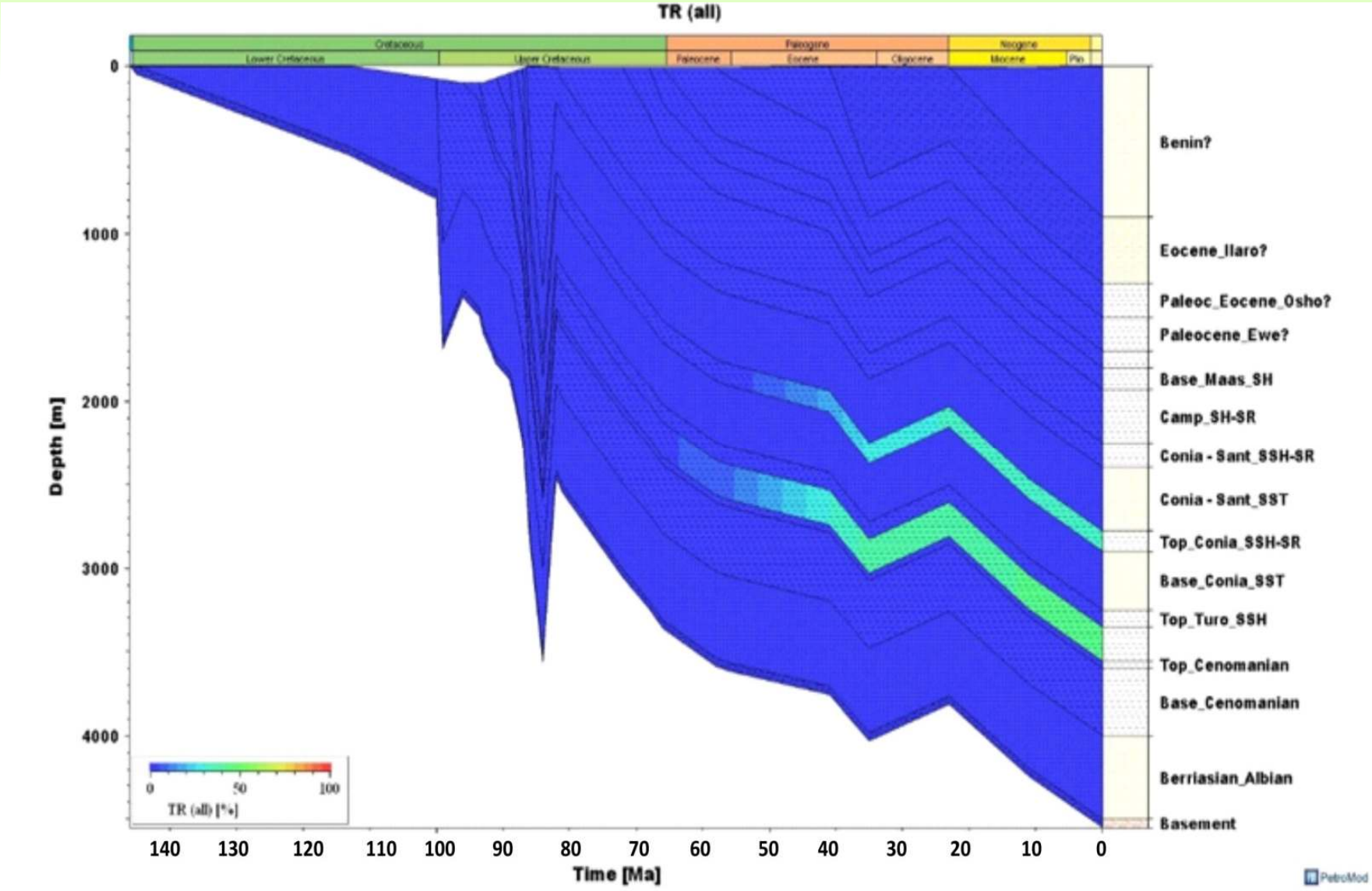
Generated and Remaining Potential in the Orimedu-1 well



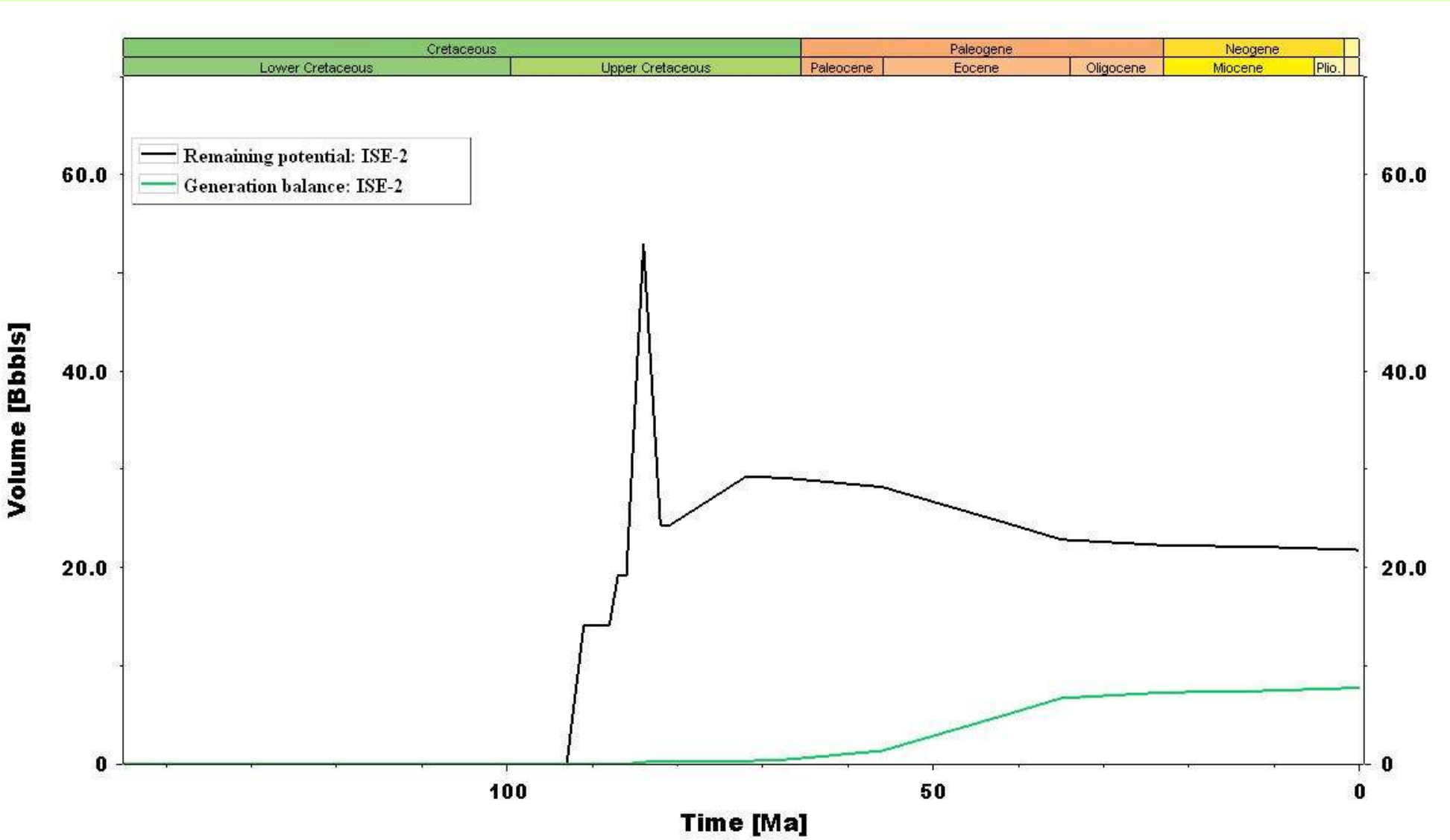
Burial and Thermal History for the Ise -2 Well



Transformation of the Potential Source Rock in the Ise -2 Well



Generated and Remaining Potential in the Ise-2 well



Conclusions

- The Cenomanian to Coniacian shales have adequate quality of organic carbon and are considered as source rocks
- 1D thermal history reveals that the Cenomanian to Turonian shales are the most mature assemblages enriched in marine oil prone kerogen; whereas Campanian – Maastrichtian shales are essentially immature to marginally mature enriched with terrigeneous gas prone kerogen;
- Our model predicts that substantial amount of hydrocarbons were generated during the transformation of the organic constituents in the Early Santonian (ca. 86Ma) in the X well Paleocene in the Ise -2 well, and;
- The average current volumetric calculations from 1D modelling suggest that at least about 3.3billion barrels of hydrocarbons could have been generated in the Dahomey Basin by the Cenomanian to Coniacian shales.
- This study for the first time discovered a Cretaceous petroleum system in the Dahomey basin, southwestern, Nigeria.

Recommendations

- The study recommended that about 3.3 billion barrels oil generated by the Cenomanian to Turonian shales needs to be further explore to confirm possible accumulations in the basin.

- 2-D and/or 3-D basin modelling needs to be carried out for further assessments of the expulsion and charging pattern of the potential source rocks, migration pathway, entrapment, and hydrocarbon trap.

ACKNOWLEDGEMENTS

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- **Alexander von Humboldt Foundation, and the PTDF for Funding**
- **Schlumberger Nigeria Limited for Burial and Maturity Modelling**

Thanks for Listening