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**PETROLEUM SOURCE ROCKS,
THERMAL MATURATION AND
HYDROCARBON PROSPECTIVITY
IN THE DAHOMEY AND ANAMBRA
BASINS OF SOUTHERN NIGERIA:
NEW INSIGHTS FROM
PETROLEUM SYSTEM MODELLING**

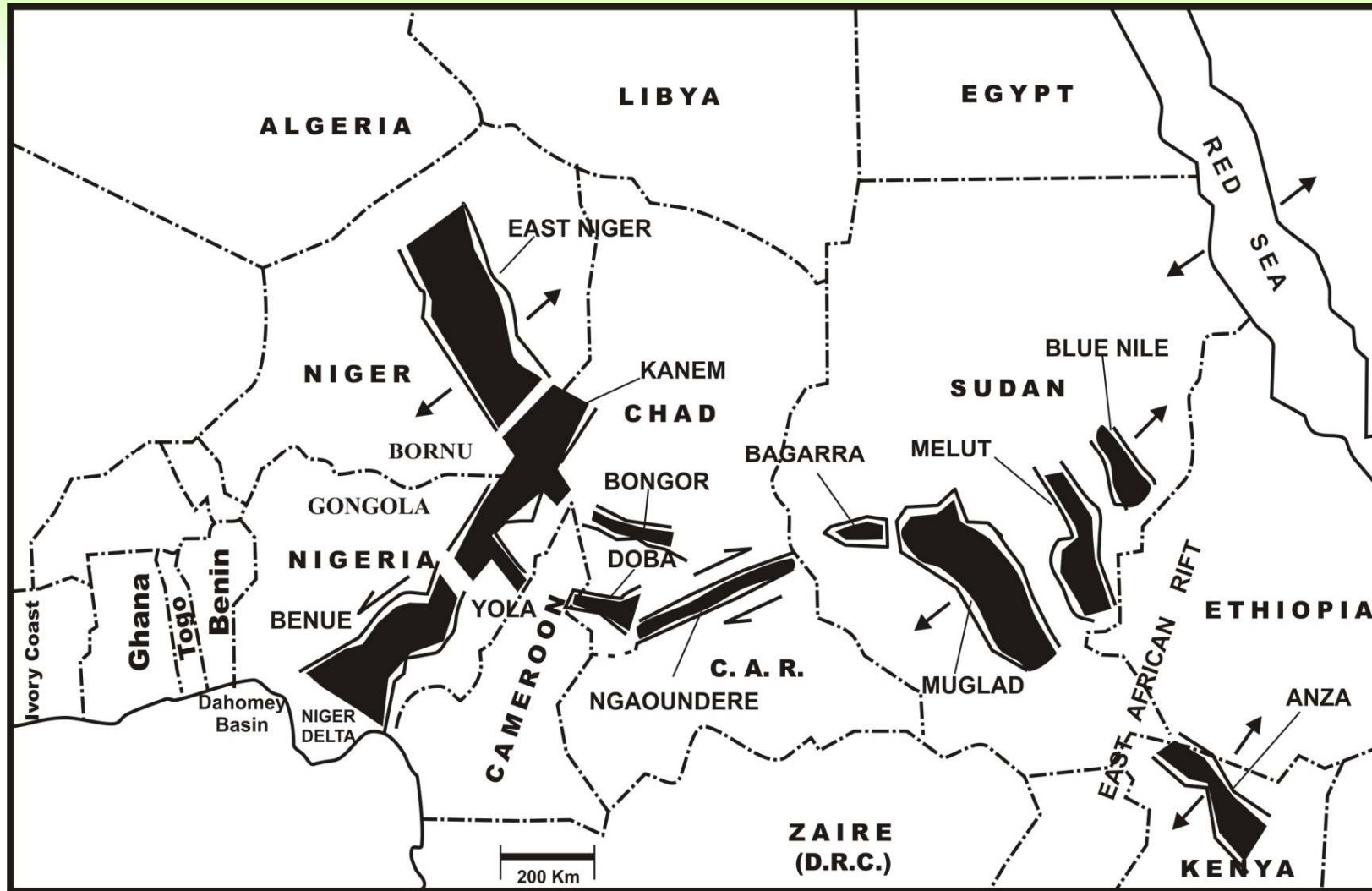
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2. Schlumberger Ltd, Lagos
3. Department of Applied Geosciences, Technical University, Berlin.
4. Petroleum Technology development Fund, Abuja.

Talk Outline

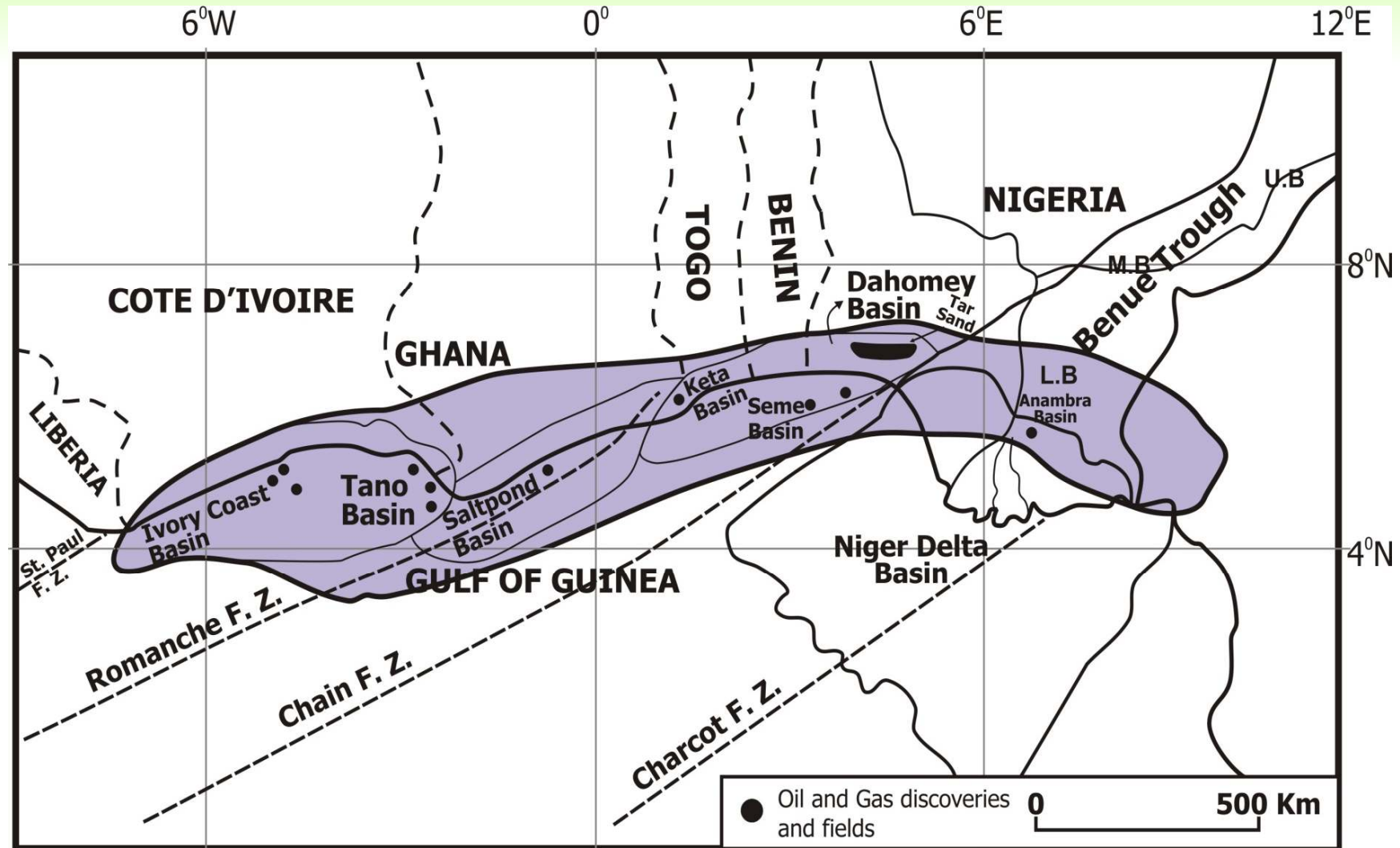
- Introduction**
- Aim and Objectives of the Study**
- Basin Setting**
- Methodology**
- Results and Interpretations**
- Conclusions**

Rift Related Basins in the West, Central and East Africa

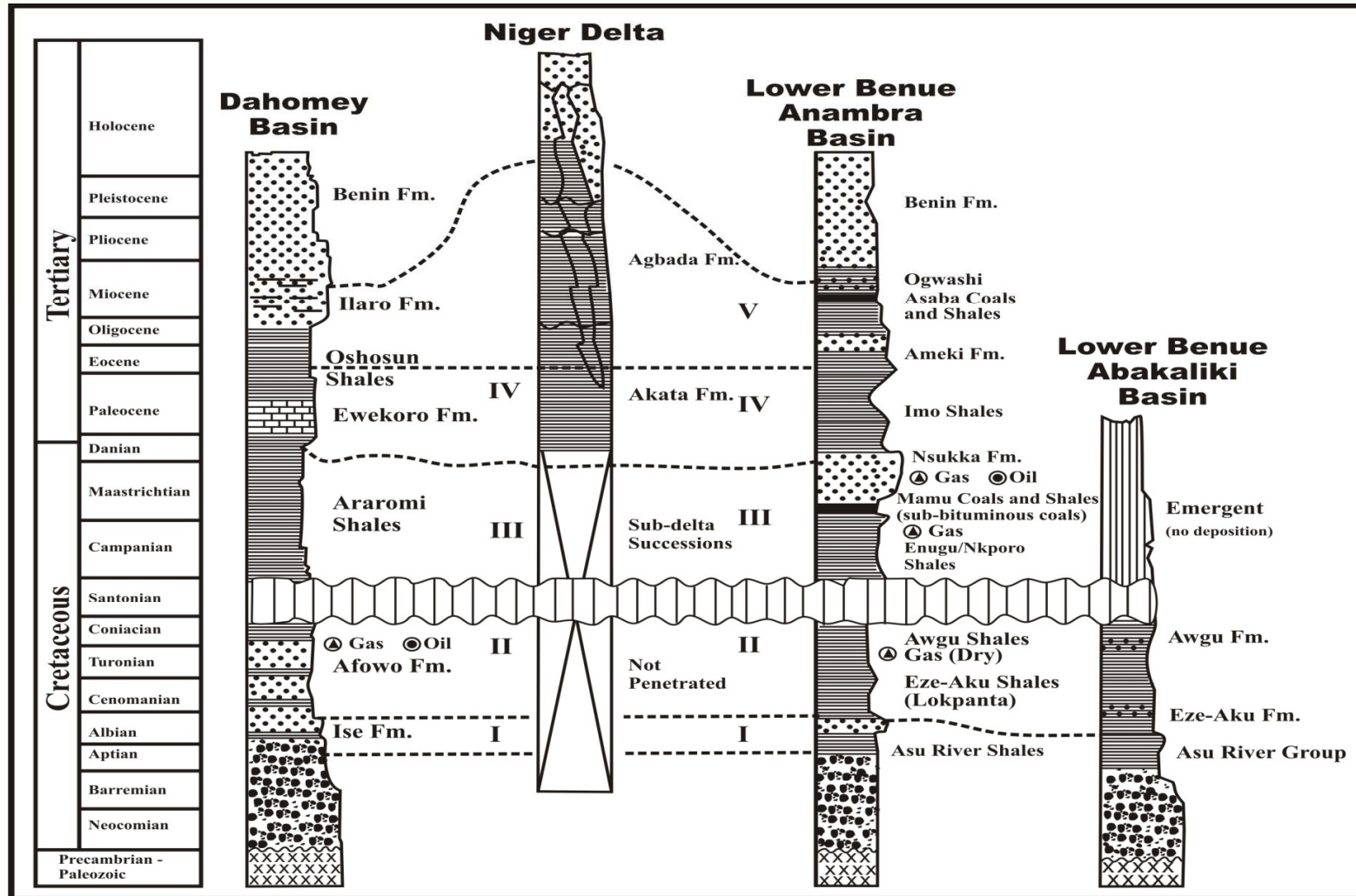


(from Schull, 1988)

Gulf of Guinea Regional Petroleum System



Stratigraphic Setting of the Dahomey, Niger Delta, Anambra and Adjacent Abakaliki Basins



Aim and Objectives of the Study

Aim:

To investigate the most promising source rock intervals from the Cretaceous successions in the Dahomey and Abakaliki/Anambra Basins.

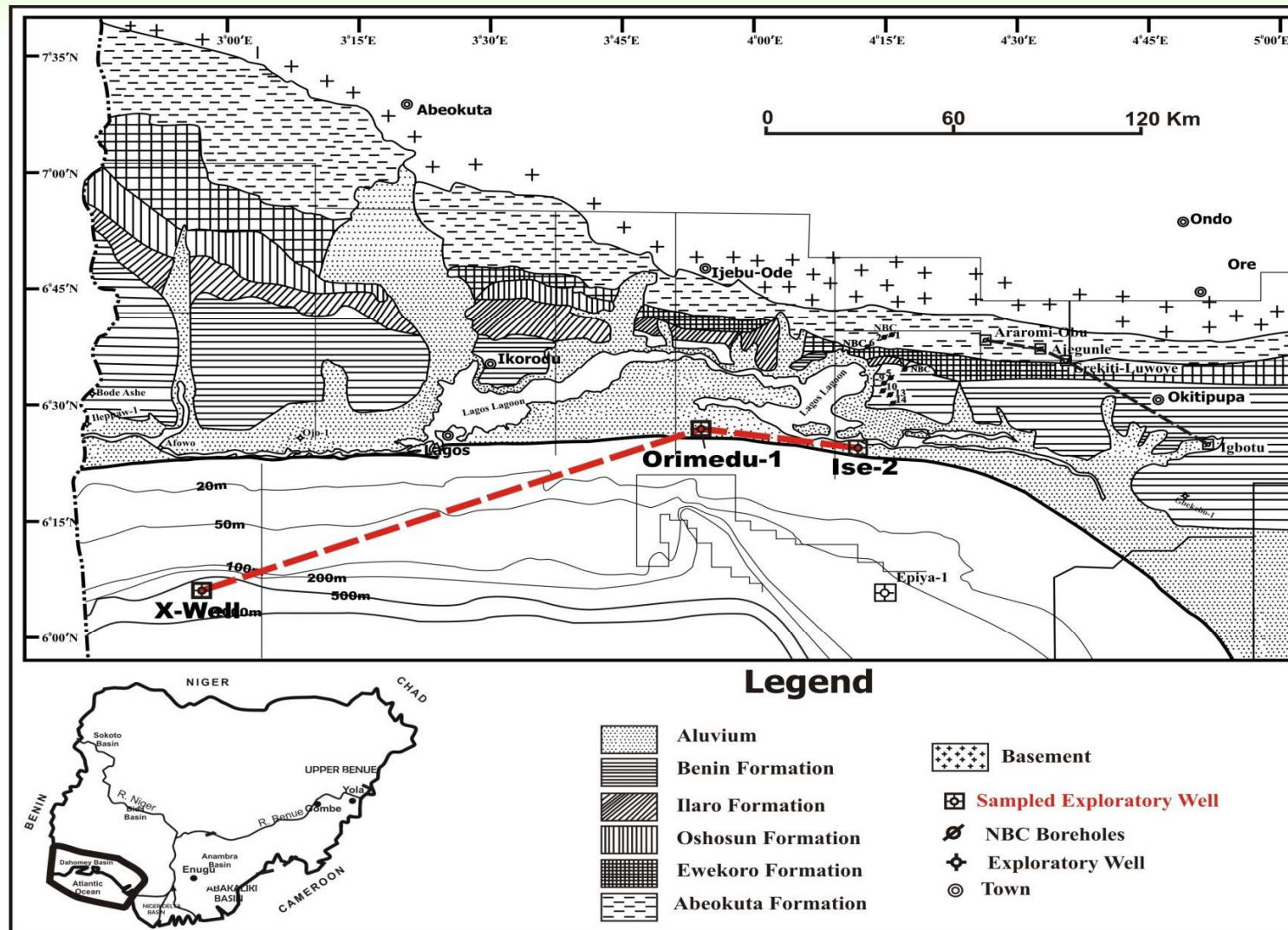
Objectives:

- 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),

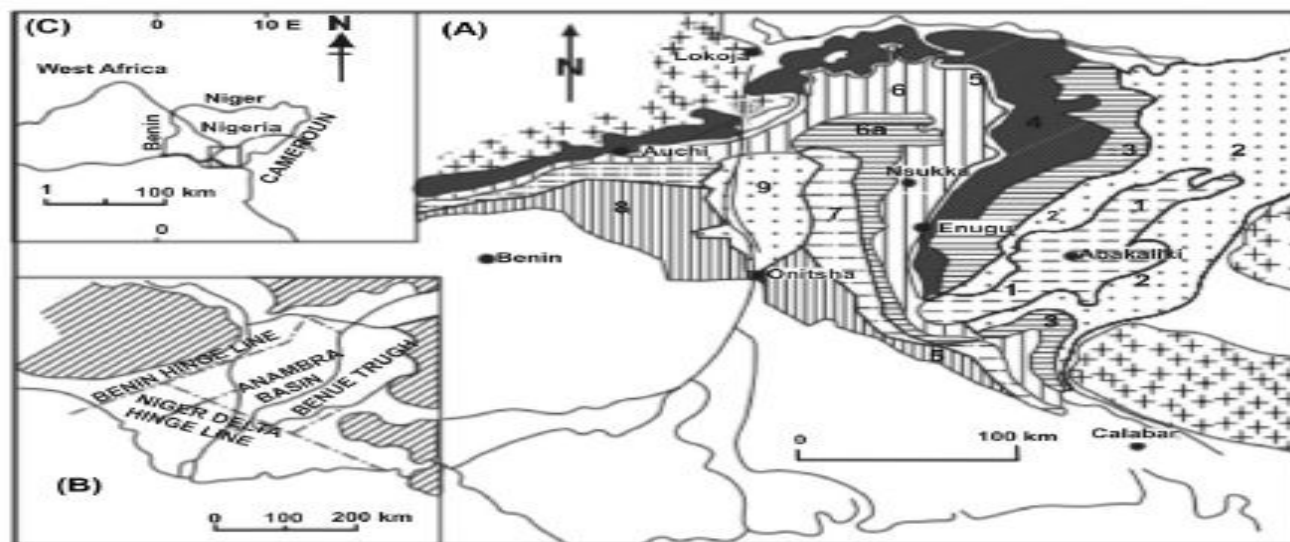
Research Methodology









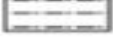


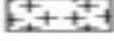

- Field Data gathering**
- Laboratory Studies**
 - ✓ **Foraminifera Biostratigraphy**
 - ✓ **Geochemical Studies**
- Thermal History Modelling**

Geological Map of the Dahomey Basin Indicating the Position of the Investigated Exploratory Wells

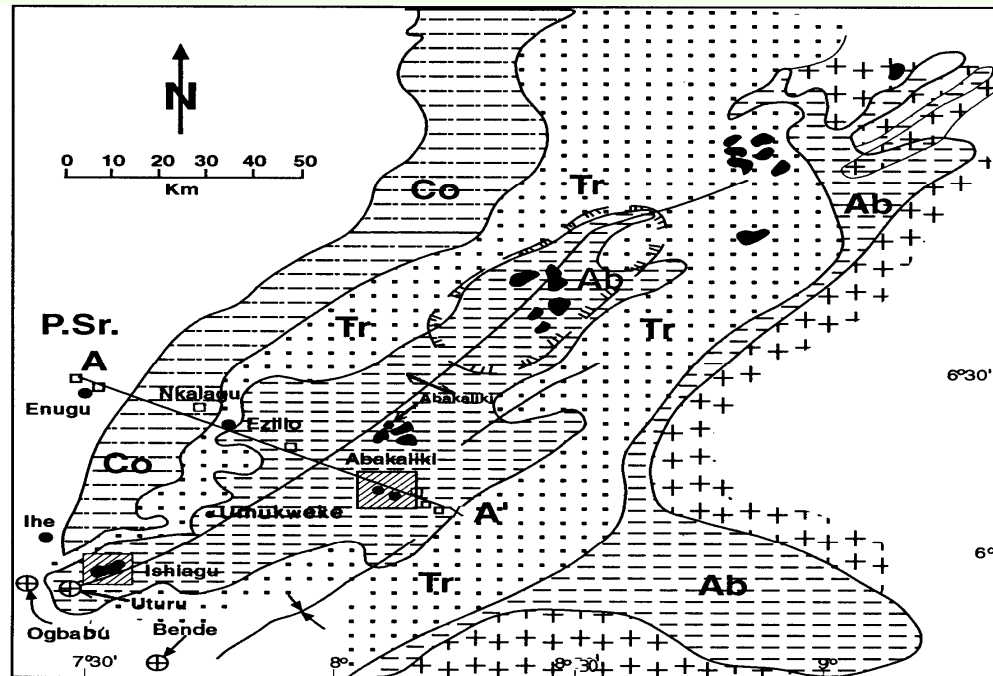


Geological Map of Southeastern Nigeria Highlighting the Position of the Anambra and the Adjoining Abakaliki Basins






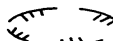






- (B)
- | | | | |
|---|---|---|-----------------------|
|  | Sedimentary basins (Cret. - Holocene) |  | 5. Mamu Formation |
|  | Crystalline basement complex rocks (Precambrian - L. Paleozoic) |  | 4. Enugu/Nkporo Shale |
|  | 9. Alluvium |  | 3. Awgu Shale |
|  | 8. Ameki Formation |  | 2. Eze-Aku Shale |
|  | 7. Imo Shale |  | 1. Asu River Group |
|  | 6a. Nsukka Formation |  | Basement Complex |
|  | 6. Ajali Sandstone | | |

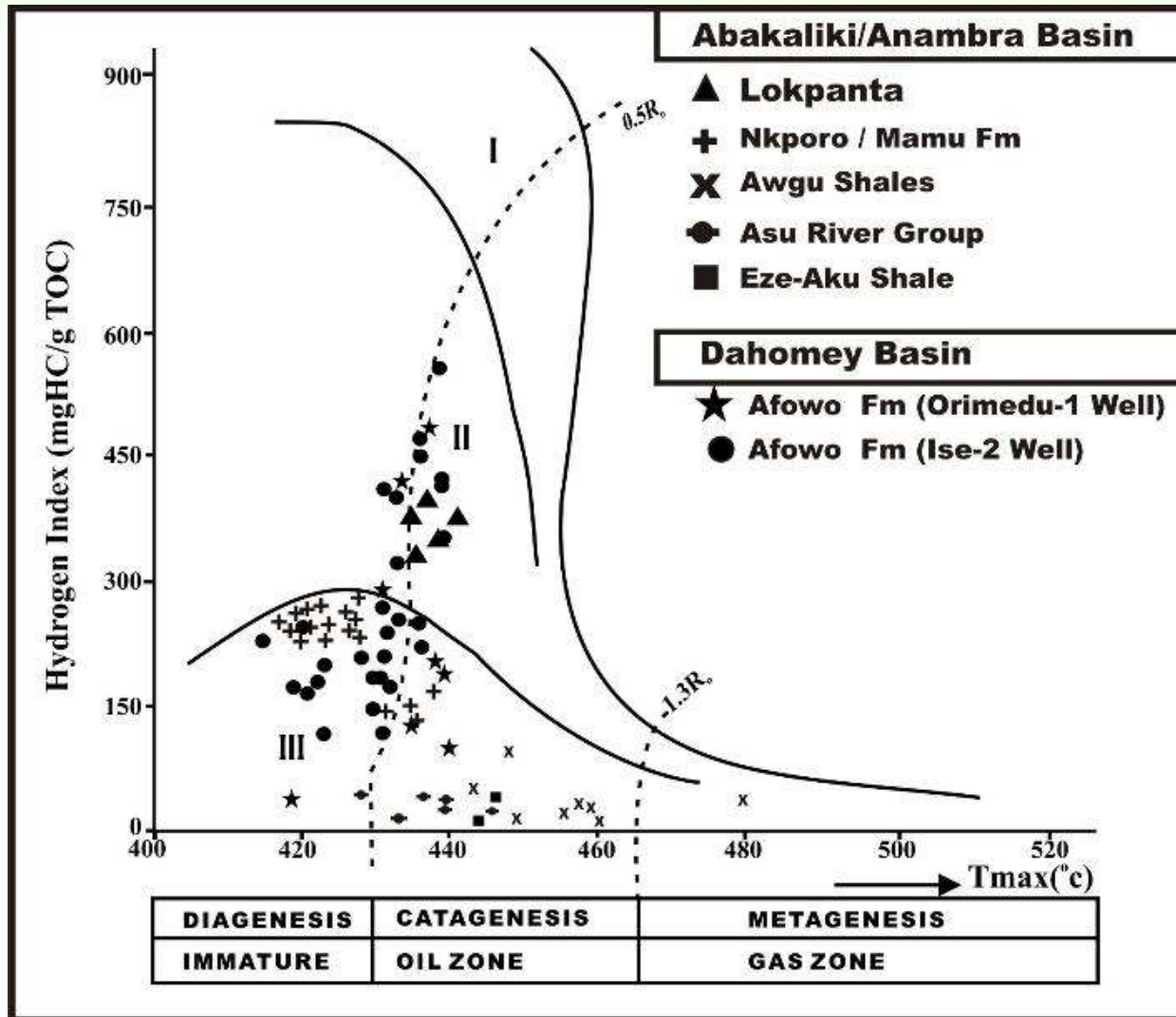
Geological Map of the Benue Abakaliki Basin showing the Position of the Bende Well and Outcrops Traverse (AA')



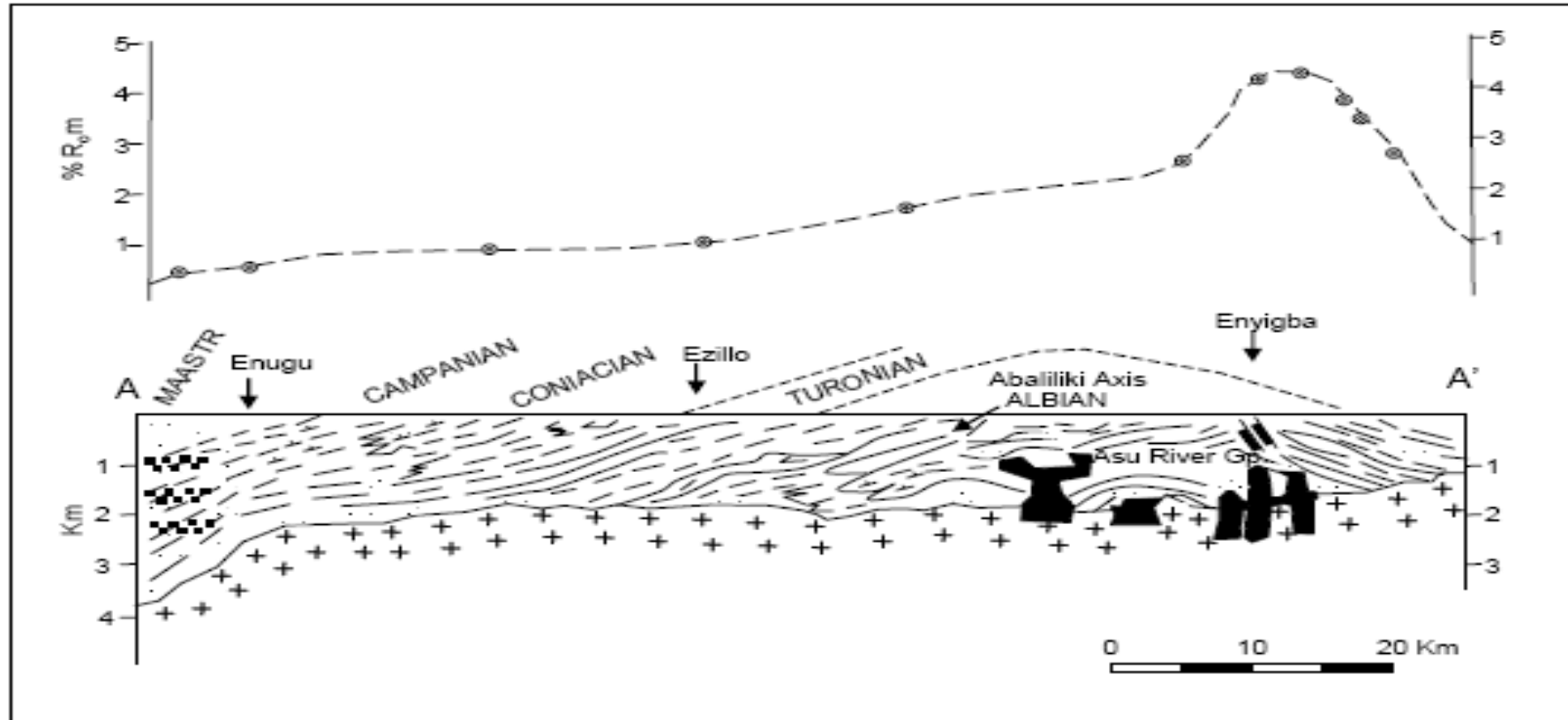
LEGEND

 P.Sr.	Post Santonian	 Basement (P.C.-L. Paleozoic)	 Cretaceous Intrusives
 Co	Coniacian (Awgu Fm.)	 Fold Axis	 Limit of low grade metamorphism (Benkheil 1989)
 Tr	Turonian (Eze Aku Fm.)	 Core Holes	 Sample locations for figure 4
 Ab	Albian (Shales of Asu River Gp.)		

Kerogen Types and Maturation of Source Rocks in the Southern Nigeria Sedimentary Basins

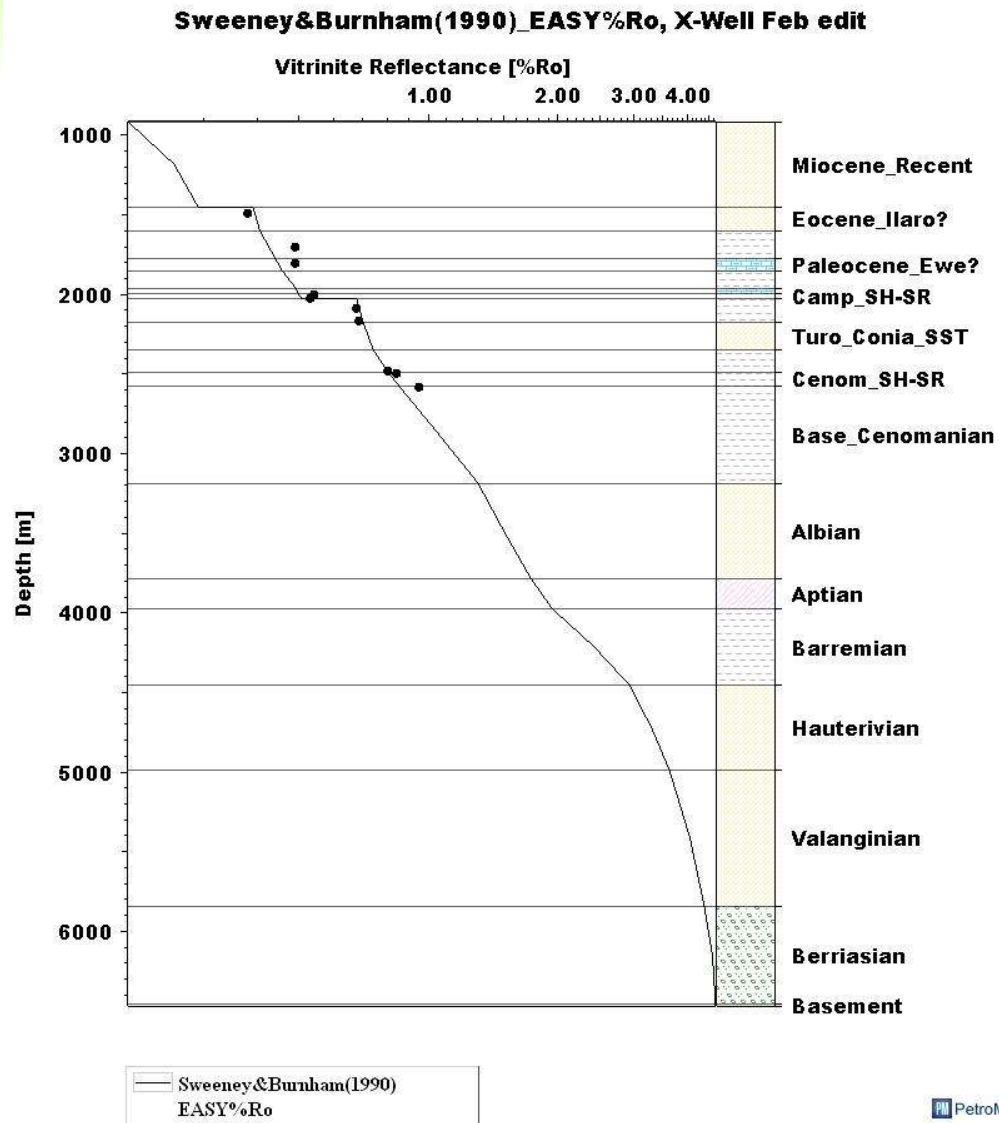


Vitrinite Reflectance Profile Across AA' in the Abakaliki Basin

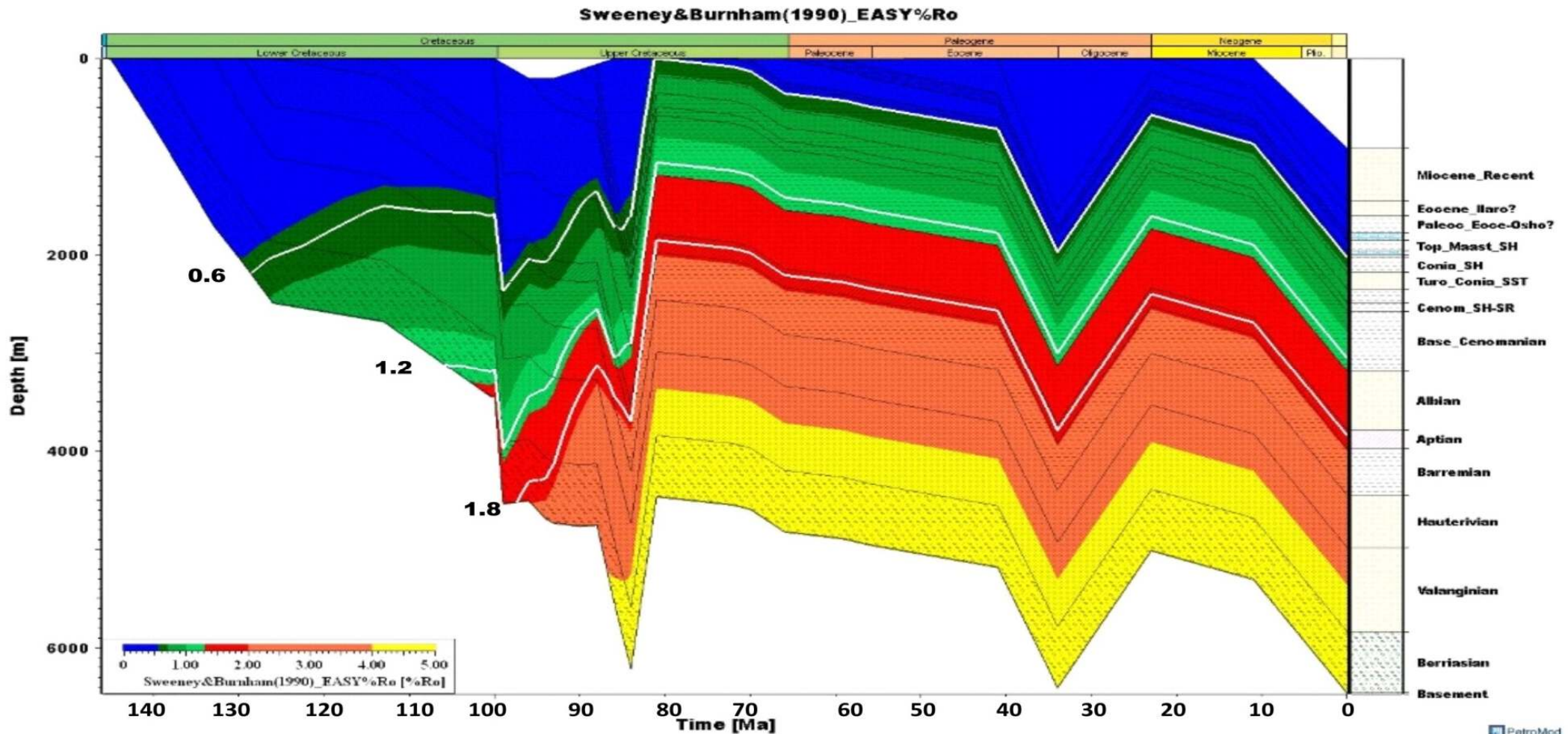


- | | | | |
|--|-----------------------|--|------------|
| | Shales | | Limestone |
| | Sandstone - Siltstone | | Intrusives |
| | Basement Complex | | Ore Veins |

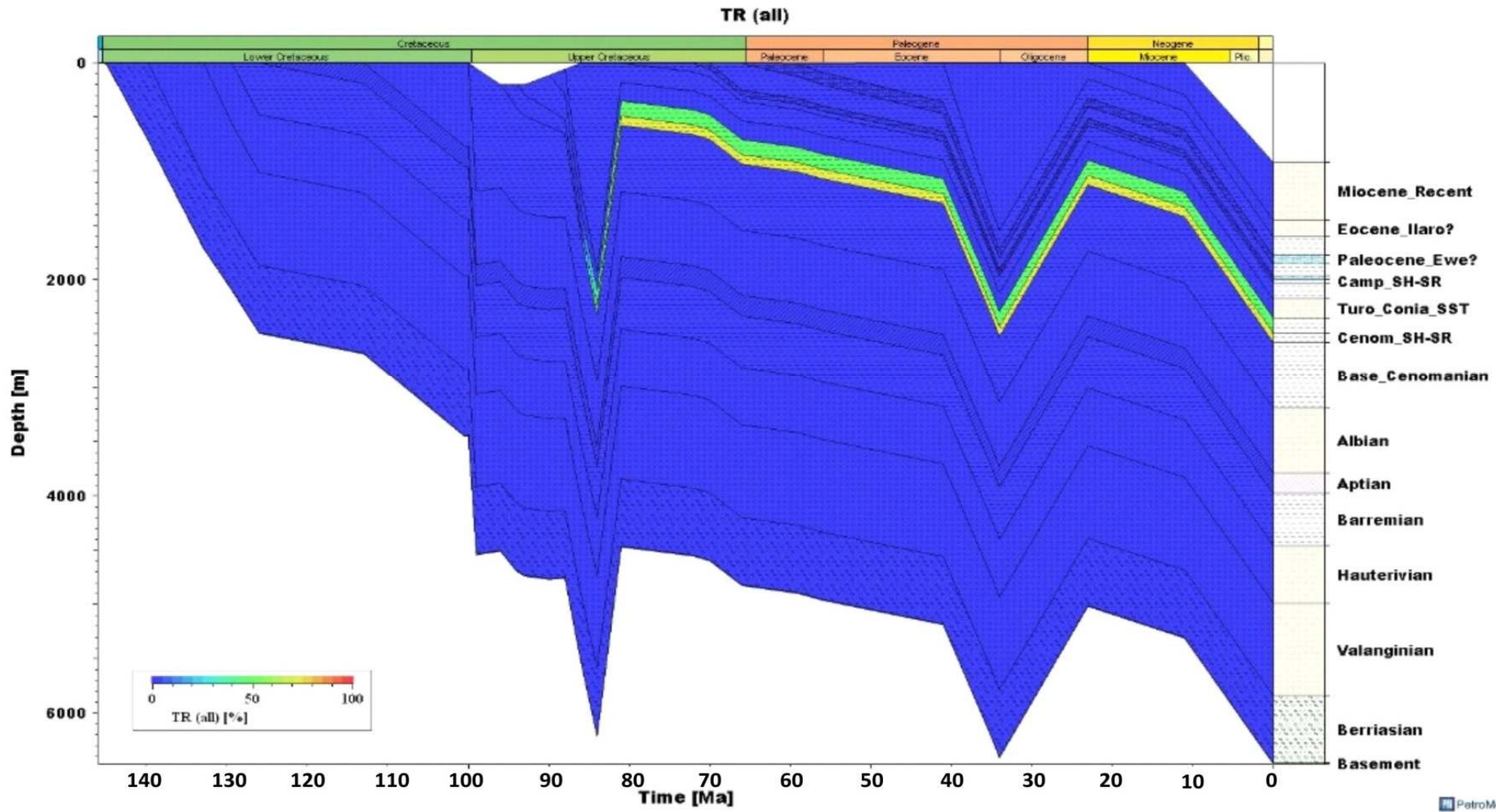
Calibrated Vitrinite Reflectance Plots of X Well



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

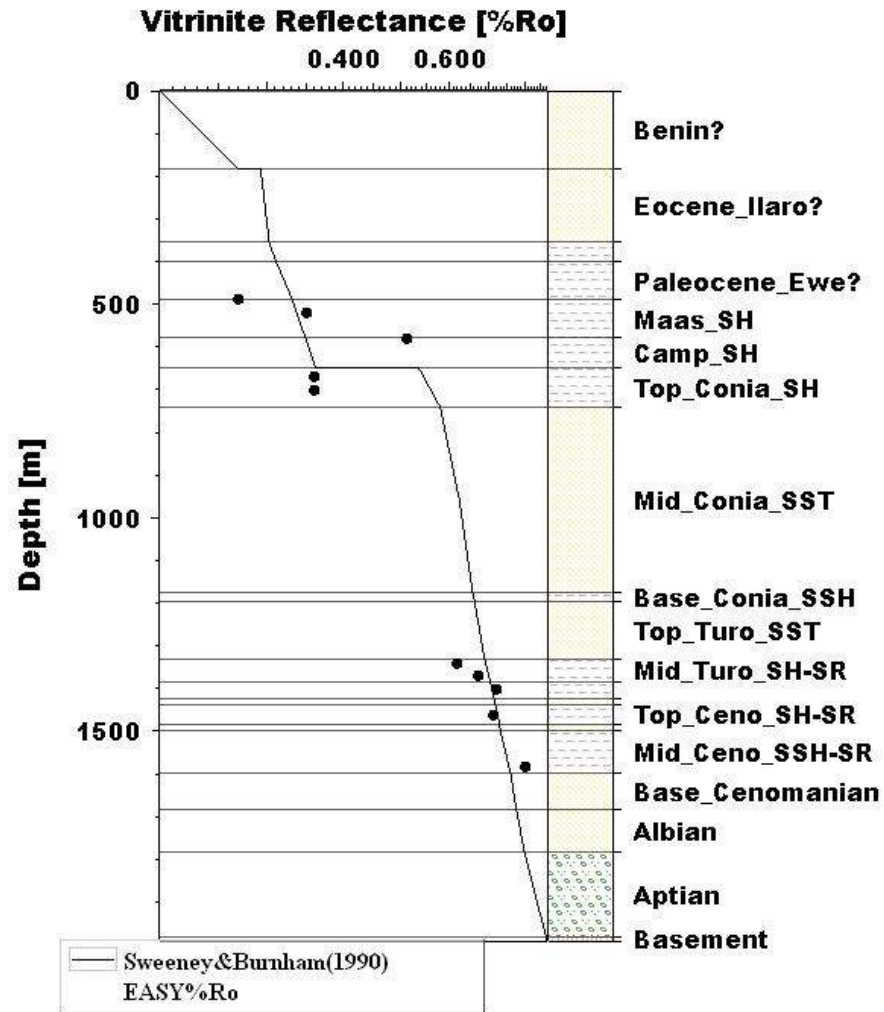


Transformation History of the X well

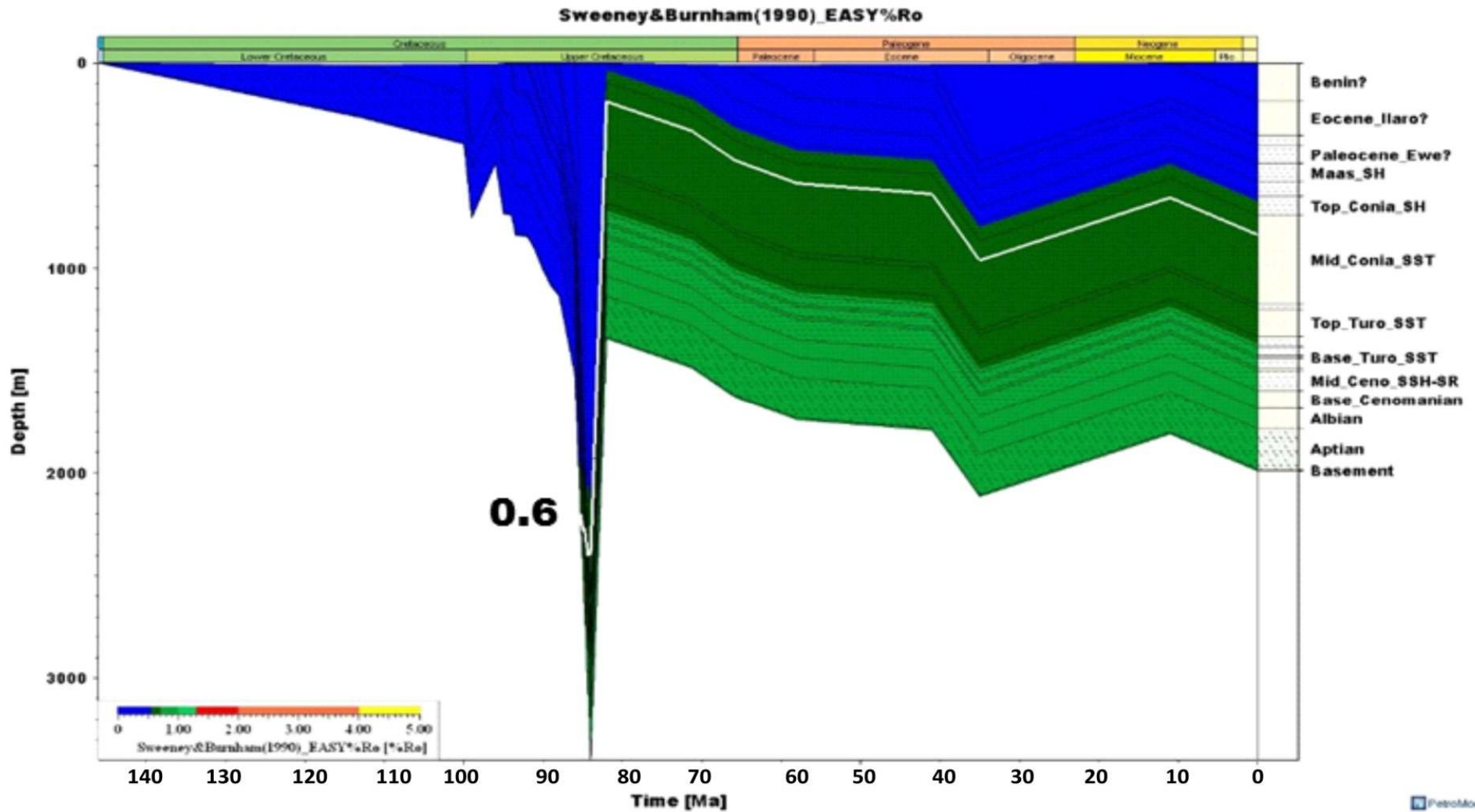


Calibrated Vitrinite Reflectance Plots of Orimedu-1 Well

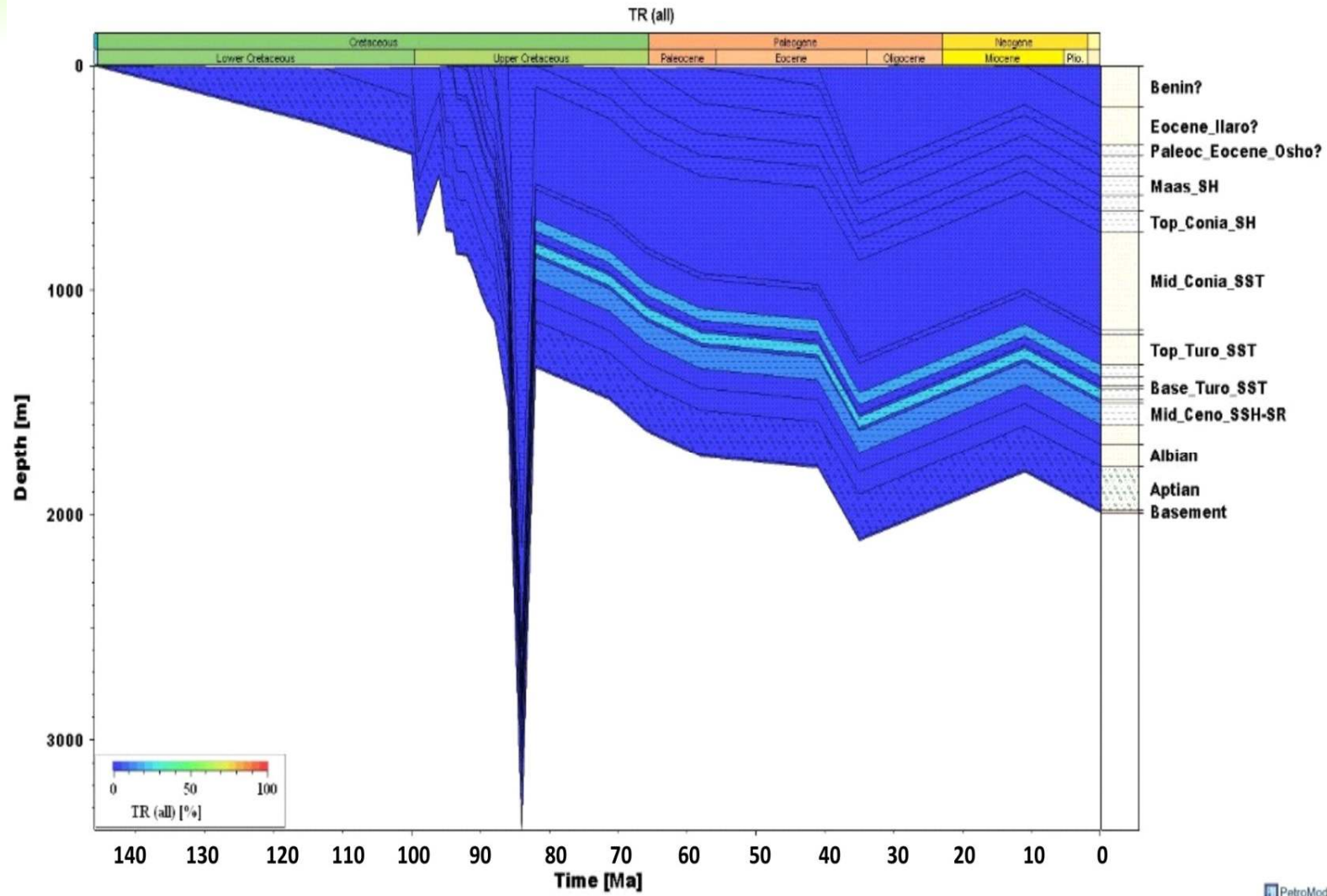
Sweeney&Burnham(1990)_EASY%Ro, ORIMEDU-1



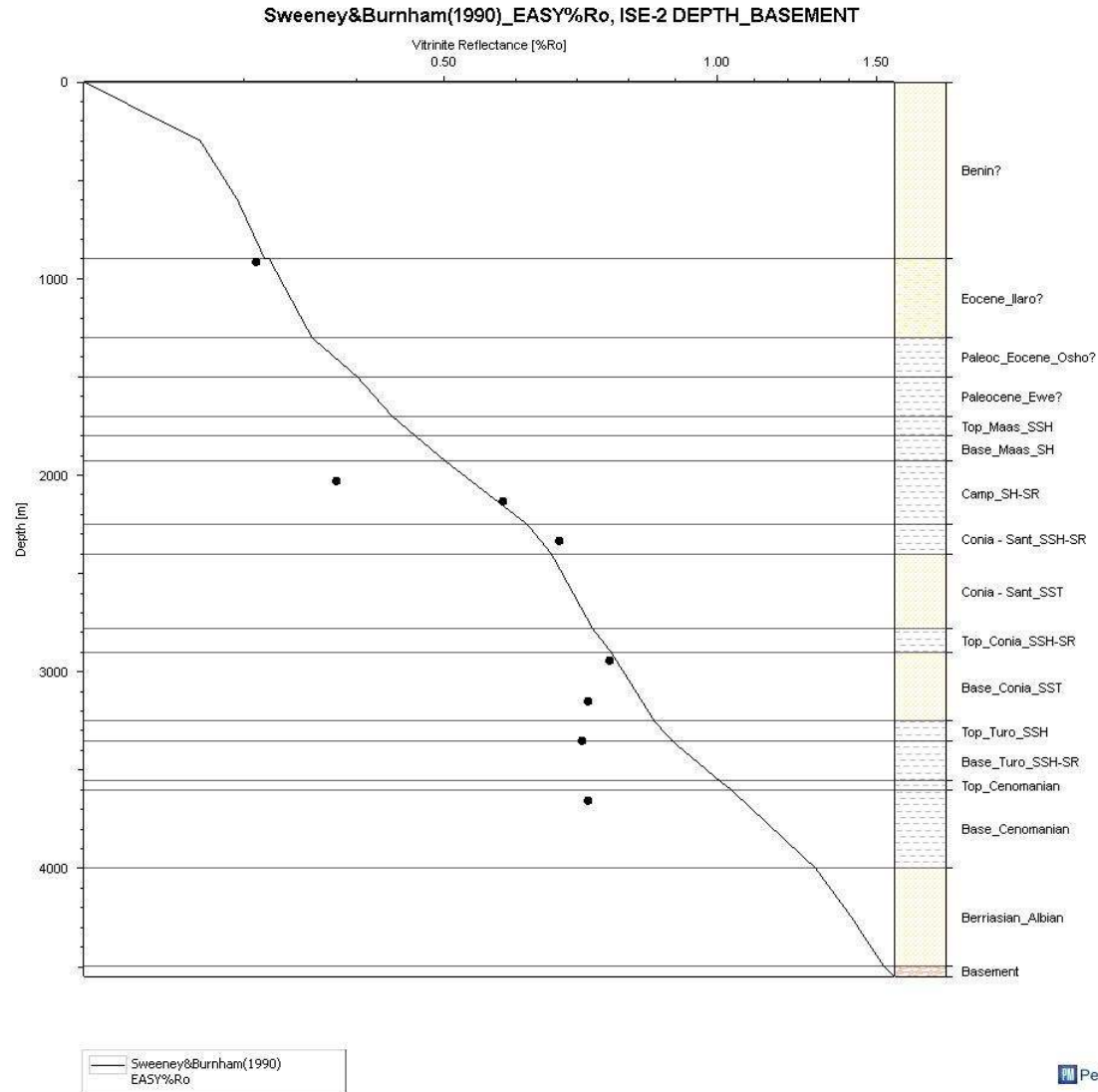
Burial and Thermal History of the Orimedu-1 Well



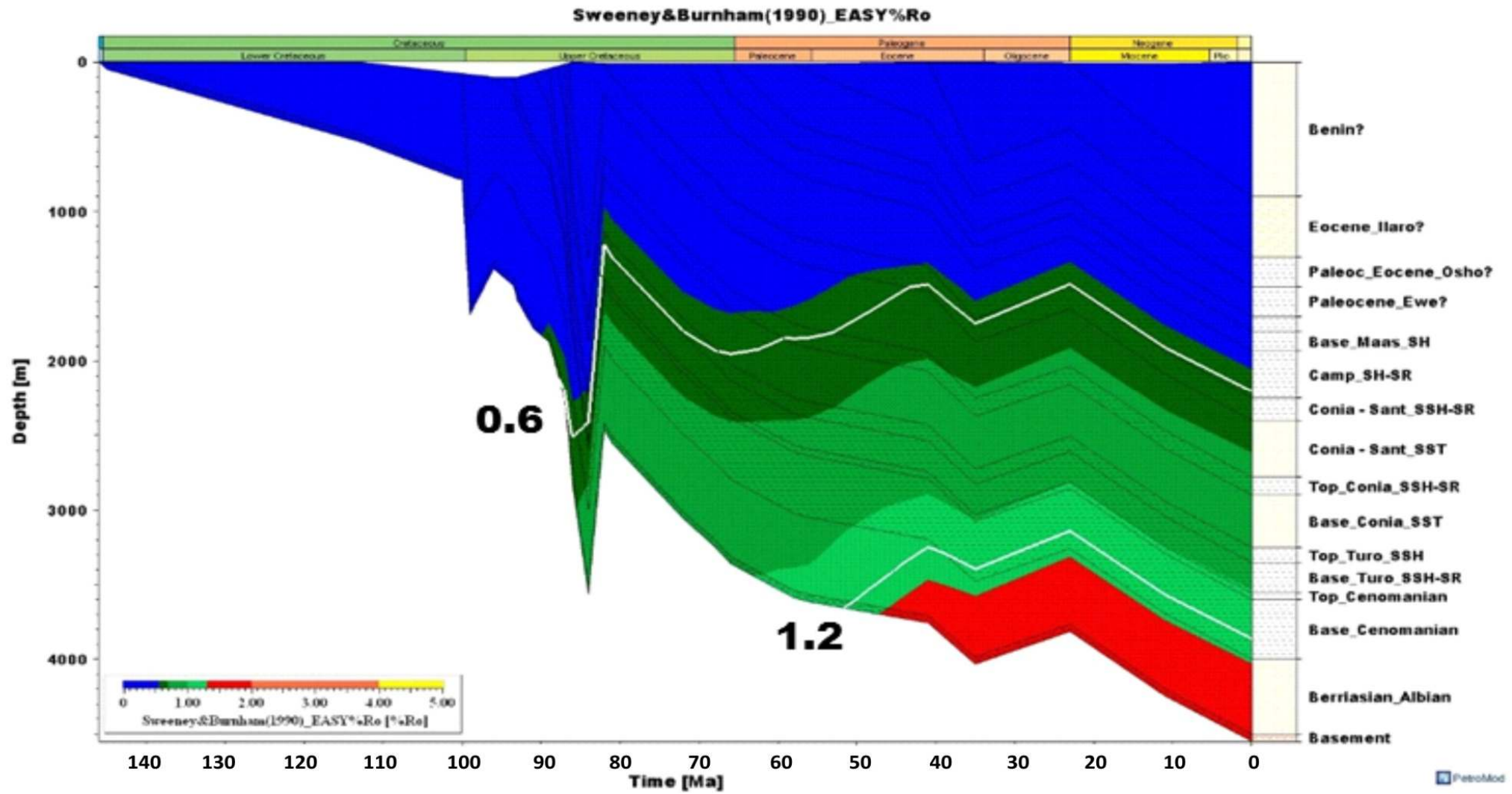
Transformation History of the Potential Source Rock in Orimedu-1 Well



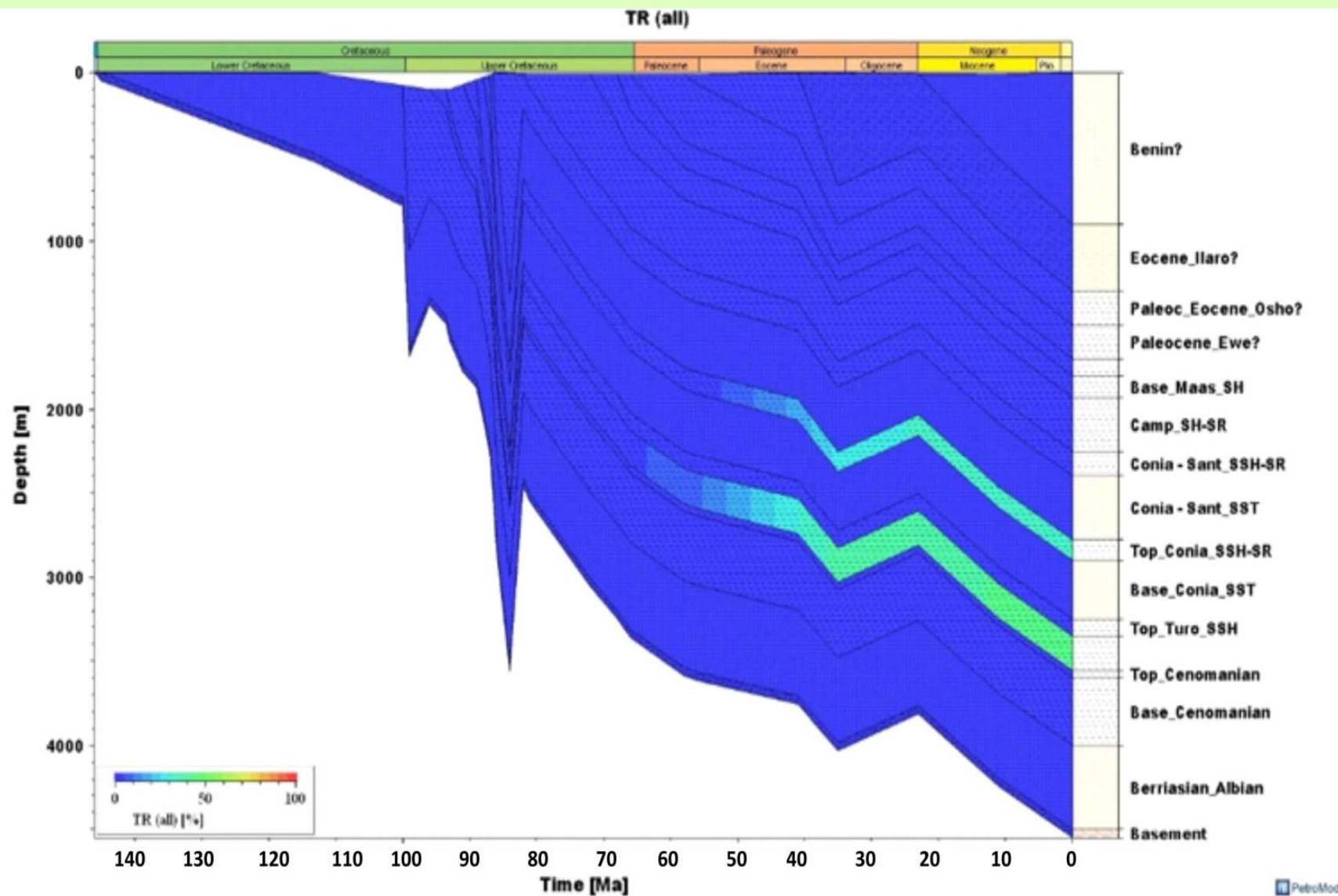
Calibrated Vitrinite Reflectance Plots of Ise-2 Well



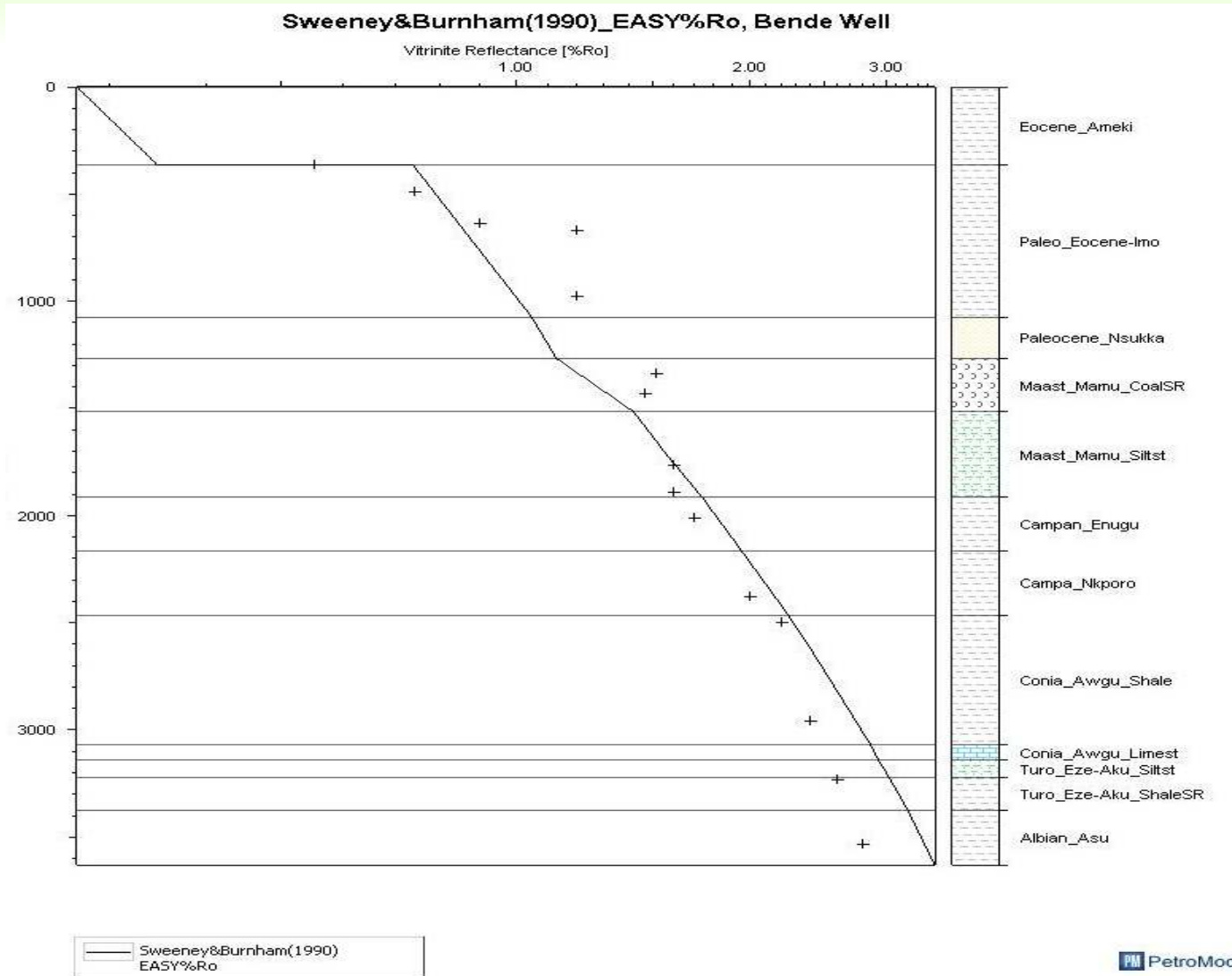
Burial and Thermal History for the Ise -2 Well



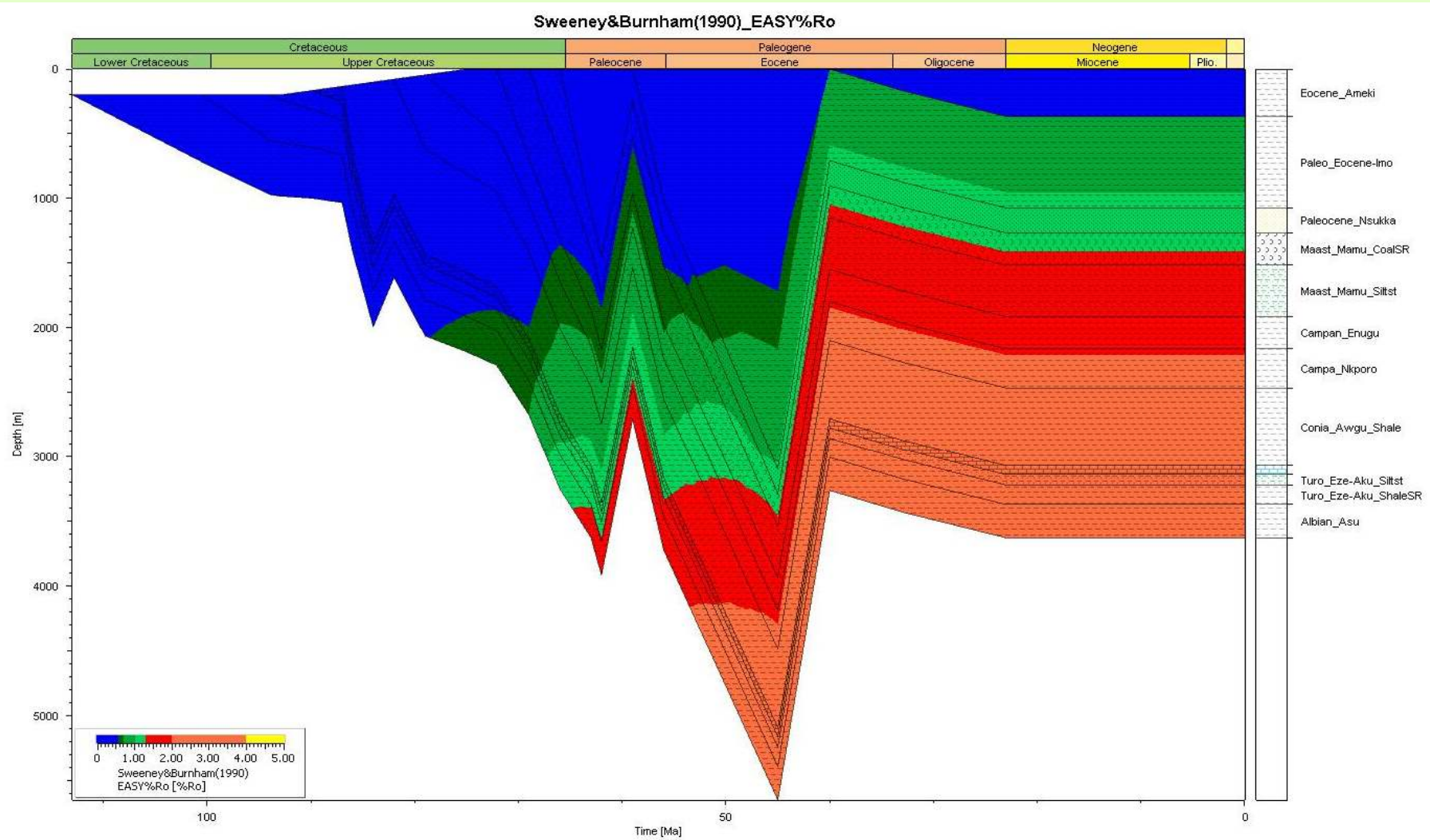
Transformation of the Potential Source Rock in the Ise -2 Well



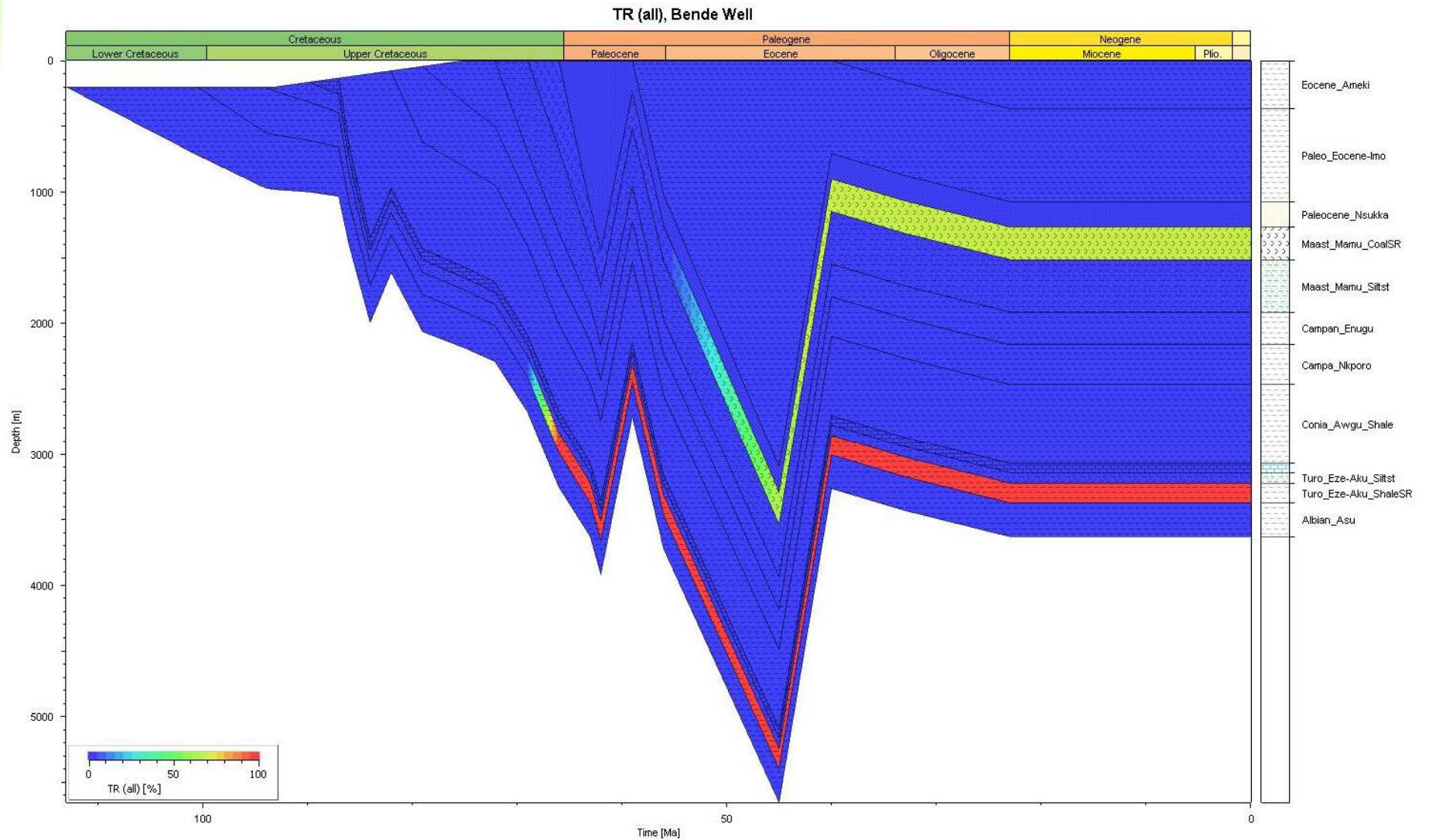
Calibrated Vitrinite Reflectance Plots of Bende Well



Burial depth versus Vitrinite reflectance - Bende Well, Anambra Basin



Transformation of Key Source Rocks - the Bende Well, Anambra Basin



Conclusions

- ❑ The Cenomanian – Turonian Afowo Shale in the Dahomey Basin contain marine oil prone facies whereas the Campanian – Maastrichtian Araromi Shale contain terrigenous gas prone constituents.
- ❑ The transformation of organic constituents to hydrocarbons commenced in the X and Orimedu-1 wells in Early Santonian (ca. 86Ma) and Paleocene.(65Ma) in the Ise -2 well.
- ❑ In the Anambra and the adjoining Abakaliki basins, the Turonian Eze-Aku Shale (with marine oil prone facies) was buried to adequate temperature and commenced hydrocarbon generation in the Santonian with its potential completely exhausted while the younger Maastrichtian Mamu Shale and coals reached mature levels in the Late Paleocene (ca. 55Ma) and commenced hydrocarbon generation with about 70% of its potential generated in the Bende well.
- ❑ Our model predicted that substantial amount of hydrocarbons have been generated with large potential still remaining in the Dahomey Basin, whereas generating potential in the Anambra Basin reached a critical time in the Early Eocene.

ACKNOWLEDGEMENTS

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- ☐ Alexander von Humboldt Foundation, and the PTDF funding support to the senior author.**
- ☐ Schlumberger Ltd for internship support to James Adeoye .**

Thanks for Listening

