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1D Basin Modeling and Geochemical Analysis of Source Rock The Arafura Basin

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ABSTRACT - The Arafura Basin is a frontier basin with significant hydrocarbon potential that remains poorly understood, particularly regarding source rock effectiveness across different structural settings. This study evaluates source rock potential, geochemical characteristics, and thermal maturity history using geochemical data and 1D basin modeling ~~on~~ from five exploration wells (ABDX-1, BRX-1, KBX-1, KLX-1, and BBX-1). The analysis identifies several potential source rock intervals ranging from Permian, Jurassic, Cretaceous, to Tertiary ages. Geochemical evaluation reveals a stark contrast between depocenters and structural highs. Wells in the northern and southern depocenters (ABDX-1 and KLX-1) contain source rocks of fair to excellent quality that have reached optimal thermal maturity phases, ranging from peak to late mature. Conversely, wells in the structural high areas (BRX-1, KBX-1, and BBX-1) are indicated to be non-generative as all source rock intervals remain immature due to insufficient burial history. Thermal history reconstruction indicates that the main phase of hydrocarbon generation occurred in the Neogene, triggered by a surge in sedimentation rates in response to the Melanesian Orogeny. This study concludes that exploration in the structural highs of the Arafura Basin carries high source rock risk, and successful hydrocarbon accumulation in these areas relies heavily on lateral migration from active hydrocarbon kitchens developing in the northern and southern depocenters.

Keyword : 1D basin modeling, geochemistry, source rock, arafura basin.

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INTRODUCTION

The Arafura Basin represents one of the frontier basins in Eastern Indonesia, which geologically possesses hydrocarbon potential but remains underexplored compared to the prolific basins in Western Indonesia. Tectonically, the basin evolution was initiated by Mesozoic rifting processes, subsequently developing into a passive margin system characterized by sediment deposition ranging from Paleozoic to Tertiary sequences (Hall 2012; Miharwatiman 2018). Its strategic position, bordering the Aru-Timor region, underscores its significance within the regional petroleum system context (Barber 2018) (Figure 1).

Mapping of exploration target basins and evaluation of oil and gas resource potential in Eastern Indonesia, particularly the Arafura Sea, has been carried out using overlay analysis based on geological and geophysical data and identification of oil and gas seepage, as reported by Suliantara (2013), which resulted in basin classification based on evidence of hydrocarbon occurrence and level of exploration maturity.

Although indications of a petroleum system have been reported in this region (Aldha 2018), comprehensive studies integrating source rock geochemical analysis with basin modeling remain limited. A major limitation of previous studies is that they predominantly emphasized tectonostratigraphic frameworks and qualitative geological assessments (Harahap 2012; Siregar et al., 2024), without providing detailed quantitative evaluations of source rock kinetics and thermal evolution. Specifically, the generative potential and maturity history of key chronostratigraphic intervals such as the Lopingian, Barremian, and Campanian sequences have not been rigorously tested using 1D basin modeling calibrated with well data. This lack of quantitative thermal modeling creates a significant knowledge gap, particularly in resolving the timing of hydrocarbon generation relative to trap formation in the structural highs versus depocenters.

Recent integrated geological and geochemical studies on eastern Indonesian basins, particularly the work by Fakhruddin et al., (2018) on the Akimeugah Basin, have demonstrated that combined analysis of well-outcrop correlations, stratigraphic architecture, and basin-scale tectonics provides critical insights for reconstructing paleographic environments and evaluating petroleum system dynamics in structurally complex frontier basins similar to the Arafura. Geochemical and basin analysis studies in Indonesian petroleum systems, as demonstrated by Sutadiwiria et al., (2022), highlight the critical importance of integrated oil-to-source rock correlation approaches for understanding petroleum system dynamics and source rock effectiveness across different structural and depositional settings.

This study addresses these issues by integrating organic geochemical analysis and one-dimensional (1D) basin modelling modeling. The approach involves a detailed evaluation of geochemical potential (S1 and S2), derived from five exploration wells (ABDX-1, BRX-1, KLX-1, KBX -1, and BBX-1) (Figure 1). Furthermore, 1D basin modelling is employed to reconstruct burial history and thermal evolution, enabling the prediction of hydrocarbon generation timing.

Well correlation techniques and paleographic reconstruction methodologies, as documented by Fakhruddin et al., (2018) in the Akimeugah Basin, Papua, provide essential frameworks for evaluating basin-scale tectonics and petroleum system components in structurally complex frontier basins such as the Arafura.

The primary output of this research is a comprehensive characterization of source rock potential and a thermal maturity model for the Arafura basin. These results are expected to provide a scientific basis for evaluating the petroleum system dynamics in frontier basins and to assist in reducing exploration risks by delineating mature source rock areas versus immature zones in Eastern Indonesia.

The tectonostratigraphic framework of the Arafura Basin, as comprehensively documented by Harahap (2012), comprises three major megasequences: Pre-rift basement assembly, syn-rift extensional architecture with graben-horst patterns, and passive margin to foreland basin development, which fundamentally control the

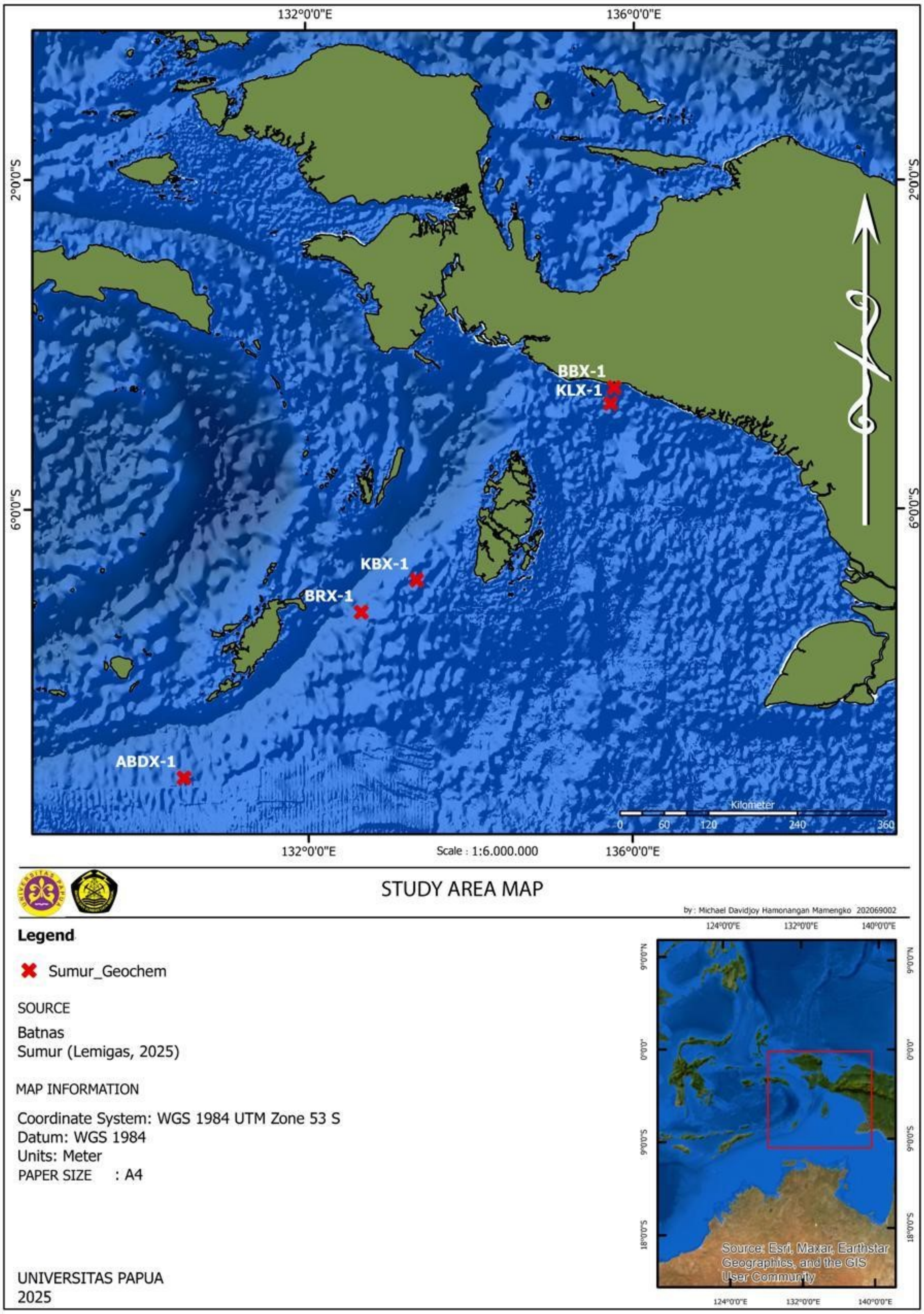

Figure .1 Regional Map of the Arafura Basin showing the location of the five exploration wells used in this study (ABDX -1, BRX-1, KBX-1, KLX-1, and BBX-1).The Basin is situated in the eastern Indonesian seaway, bounded to the north by Papua Island, to the west by the Banda Sea and Tanimbar Trough, an to the east by the Arafura Sea. Well ABX-1 and BRX-1 are positioned in the southwest depocenter, while KBX-1 occupies a central basin position. KLX-1 are located in the northern structural high domain near the Papua Island margin. This spatial configuration allows for a north to south geochemical and thermal maturity comparison between depocenter and structural high setting, which is central to the petroleum system analysis presented in this study.

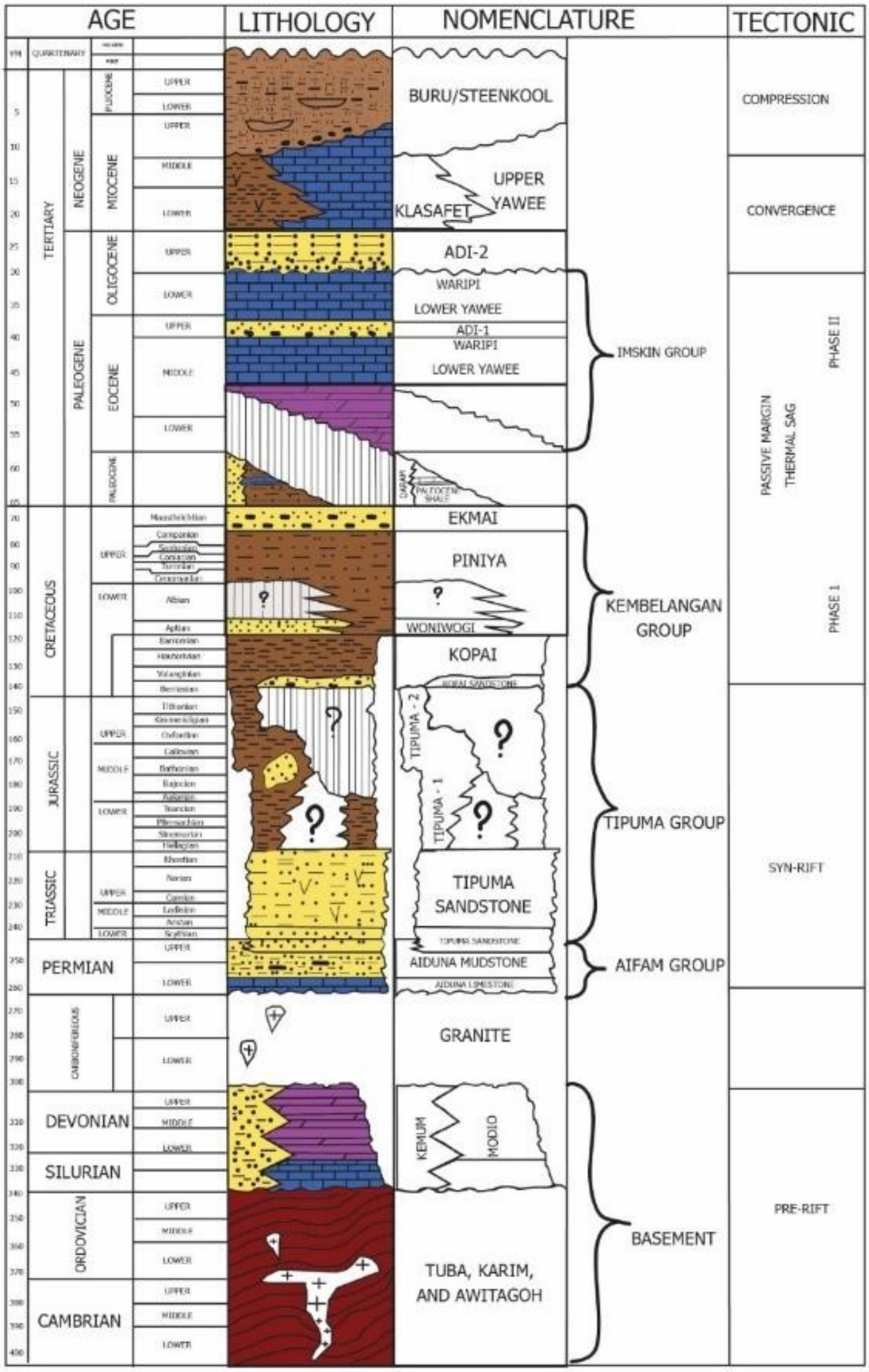

Figure 2. Tectonostratigraphic chart of the Arafura Basin from (Harahap 2012) showing the distribution of potential source rocks across Pre-rift, Passive Margin, and Foreland Basin megasequences.

distribution and maturity of potential petroleum source rocks. Source rock potential in the Arafura Basin comprises multiple stratigraphic intervals (Harahap 2012). The Aiduna Mudstone (Permian) (McLennan et al., 1990) provides limited petroleum-generation capacity due to moderate organic richness. The primary source rock interval consists of organic-rich, marine shales within the syn-rift Jurassic succession, which accumulated under basin-center anoxic conditions favorable for hydrocarbon generation. Paleocene-Oligocene dark mudstone intervals within the carbonate platform sequence contribute supplementary source rock potential (Aghayeva et al., 2023). Source rock correlation and geochemical characterization studies, such as those conducted by Sutadiwiria et al. (2022) in comparable Indonesian basins, demonstrate the importance of integrating organic geochemical analysis with basin tectonic context for identifying petroleum source and migration pathways. In the Arafura Basin, organic matter maturity and petroleum generation timing vary significantly as a function of burial depth controlled by syn-rift and syn-orogenic subsidence patterns. Paleozoic source rocks in deeply-buried structural lows achieved thermal maturity appropriate for hydrocarbon generation, while similar intervals in structural highs remain immature due to insufficient burial (Hall 2012). This spatial variation in source rock effectiveness creates exploration risk in uplifted areas, requiring reliance on lateral petroleum migration from active kitchen areas in depocenters.

The stratigraphic chart's lithologic pattern (brown coloring for mudstones) identifies intervals with potential source rock characteristics, particularly dark mudstone units interbedded within carbonate platforms. Lithofacies associations demonstrate that organic-rich mudstones interstratified with carbonates exhibit optimal source rock characteristics in restricted paleomarine settings. Regional petroleum synthesis for the western Arafura Sea documents good source rocks in Cambrian, Carboniferous and Jurassic–Cretaceous sequences, with maturation biased toward early graben development (McLennan et al., 1990). Detailed Permian source rock work on the North Arafura Shelf (Papua) identifies two Permian intervals: one good –very good (TOC ~3 wt%, type II/III kerogen, mature) and one fair quality (TOC ~1 wt%, type II kerogen, mature) (Sabra 2021).

METHODOLOGY

This study used secondary data derived from final well reports of five exploration wells: ABDX-1, BRX-1, KBX-1, KLX-1, and BBX-1, provided by LEMIGAS. The dataset comprises lithological descriptions, biostratigraphic ages, and geochemical data, including Total Organic Carbon (TOC), Rock-Eval pyrolysis (S1, S2, Tmax, HI), and Vitrinite Reflectance (Ro). One-dimensional (1D) basin modeling was performed using basin modeling modelling software to reconstruct the burial and thermal histories of the basin (Hantschel & Kauerauf, 2009).

Geochemical analysis was conducted to assess the quantity, quality, and maturity of organic matter. The quantity of organic matter was evaluated based on TOC (wt%) and petroleum potential (S1 and S2), while the quality (kerogen type) was determined using Hydrogen Index (HI) and Oxygen Index (OI) plotted on a modified Van Krevelen diagram (Peters & Cassa 1994). Thermal maturity was assessed using Vitrinite Reflectance (Ro) and Tmax data. Prior to interpretation, HI and TOC values were corrected to their original pre-maturation conditions to accurately reconstruct the initial generative potential of the source rocks (Justwan & Dahl 2005).

The 1D basin modeling workflow involved the integration of stratigraphy, lithology, and erosion events. Erosional thickness was estimated using vitrinite reflectance trend analysis, specifically by identifying trend breaks indicative of uplift events. Boundary conditions for the thermal model included paleo-water depth (PWD), sediment-water interface temperature (SWIT), and heat flow (HF). PWD was interpreted from biostratigraphic data indicating paleo-environments, while SWIT was automatically calculated using the Wygrala (1989) model based on paleo-latitude and water depth. The heat-flow history was reconstructed based on the tectonic evolution of the Arafura Basin, assuming higher heat flow during rifting phases and exponential decay during passive margin phases (Allen & Allen 2005). The thermal models were calibrated against measured Vitrinite Reflectance (Ro) and corrected Bottom Hole Temperature (BHT) data. BHT data were corrected to static formation temperatures using DST data or the Andrews-Speed et al. (1984) method where applicable. Thermal maturity and hydrocarbon generation were simulated using the EASY%Ro kinetic model by Sweeney and Burnham (1990), which is widely accepted for evaluating maturation in sedimentary basins.

Petroleum systems in Indonesian basins demonstrate predictable patterns of source rock distribution and maturity (Widarsono et al., 2023) that provide analogs for basin development. Integrated methodologies combining stratigraphic analysis, geochemical characterization, and basin modeling provide powerful tools for petroleum system evaluation in structurally complex settings (Sutadiwiria et al., 2022).

According to Harahap (2012), The tectonostratigraphic chart presents a comprehensive vertical stratigraphic column of the Arafura Basin, integrating age, lithology, formation nomenclature, and tectonic phases across a timespan from Cambrian to Quaternary (approximately 500+ million years). The chart illustrates three major megasequences distinguished by contrasting tectonics and depositional styles: 1). Pre-rift phase with basement assembly; 2). Syn-rift phase characterized by extensional graben-horst architecture, and; 3). Passive Margin and Foreland Basin phases reflecting passive subsidence and collision-driven compression. This integrated framework demonstrates how tectonic evolution fundamentally controlled stratigraphic architecture and petroleum system development throughout the basin's history.

RESULT AND DISCUSSION

Source rock characteristics and geochemical properties.

The evaluation of five exploration wells reveals that potential source rocks in the Arafura Basin are stratigraphically distributed across three main : the Pre-rift/Syn-rift (Permian-Jurassic), Passive Margin (Cretaceous), and Foreland Basin (Cenozoic) sequences (Siregar et al., 2024). Geochemical evaluation indicates that source rock potential in the Arafura Basin is stratigraphically distributed across the Pre-rift to Passive Margin megasequences. To provide a high-resolution characterization of these sequences, the vertical distribution of pyrolytic parameters for the representative southern depocenter well, ABDX-1, is presented in the geochemical composite log (Figure 3). This profile integrates lithological variations with in situ organic richness (TOC) and generative potential (S1, S2).

In the southern depocenter (Well ABDX-1), the Barremian (Cretaceous) and Bajocian (Jurassic) intervals demonstrate consistent organic richness, averaging 2.10 wt% and 1.82 wt% TOC, respectively. The vertical profile (Figure 3) confirms an late stage thermal maturity stage, with Tmax values ranging from 452.83°C (Barremian) to 456.28°C (Bajocian). The generative quality of these intervals is further validated by the modified Van Krevelen diagram (Figure 4), where samples predominantly cluster within the Type II/III oil-prone kerogen zone.

A sharp geochemical contrast is observed regionally, as summarized in the quantitative data in Table 1. While the northern depocenter (Well KLX-1) exhibits exceptional potential in the Permian interval, with TOC values averaging 6.42 wt% and S2 values reaching 186.49 mgHC/g, whereas the structural highs remain non-generative. For instance, despite the high organic richness observed in the Piacenzian interval of Well BBX-1 (avg. 6.48 wt% TOC), these source rocks are thermally immature and characterized by gas-prone Type III kerogen.

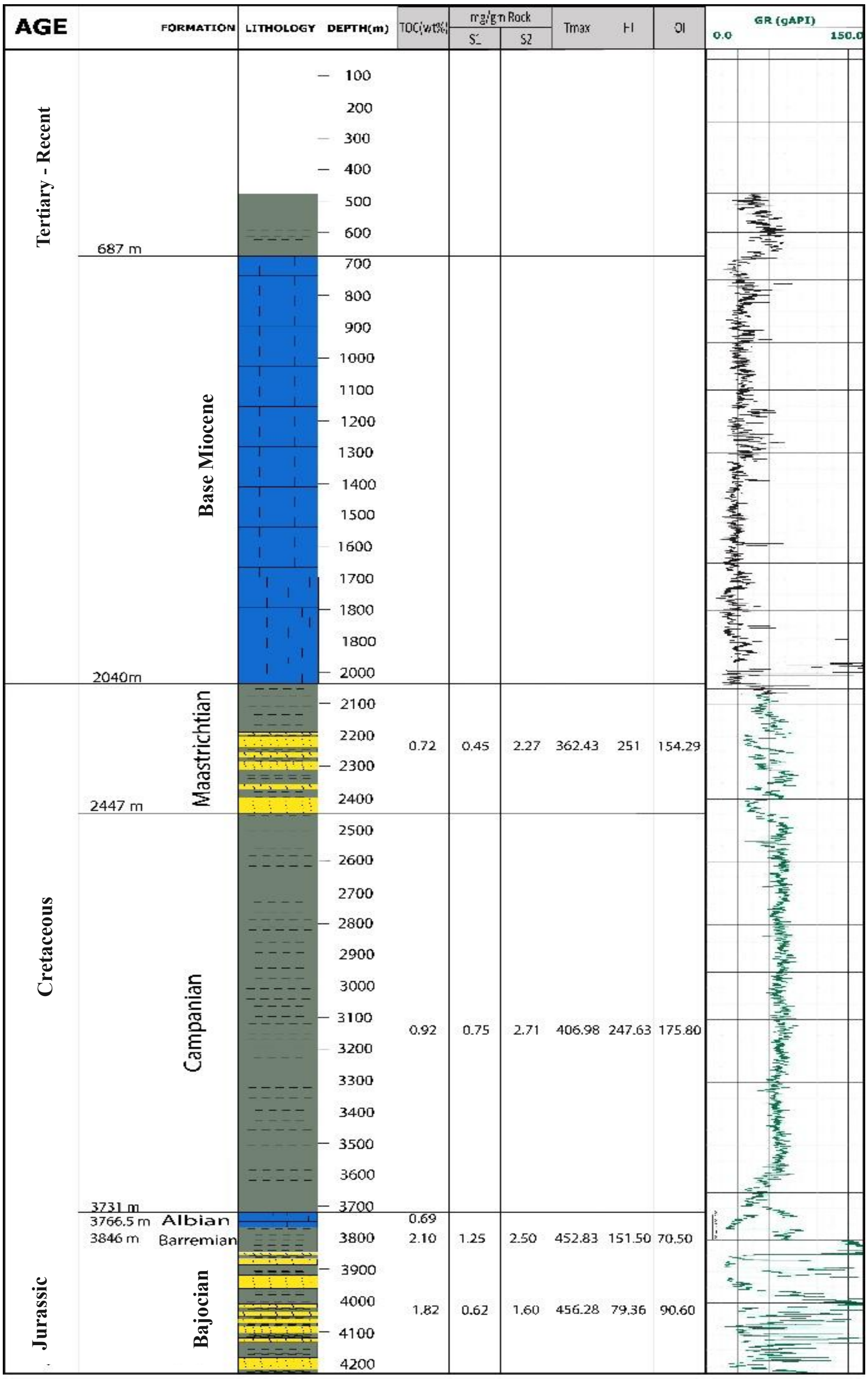

Figure 3. Geochemical composite log of Well ABDX-1dsiplaying stratigraphic distribution of source rock parameters (TOC, S1, S2, HI, OI and Tmax) across Jurassic-Cretaceous sequences . The Masstrichtian Interval (~ 2477 m) records elevated HI (~762 mg HC/g OC) with moderate TOC (0.26%), indicating good oil generative potential despite thin development. The Campanian interval (~3231 m) shows TOC of 0.92% with HI ~407 mg HC/g OC, consistent with Type II–III mixed kerogen and fair-to-good source rock quality. The Albian interval (~3766 m) yields TOC of 2.19% and HI ~413 mg HC/g OC, representing the most promising source rock interval in terms of organic richness. The Bajocian (Jurassic) section at ~3846 m displays the highest TOC (1.62%) but lower HI (~456 mg HC/g OC), suggesting mixed to gas-prone kerogen character. Overall, the log reveals an overall deepening trend toward better source rock development, with the Albian and Bajocian intervals identified as the principal source rock candidates in the ABDX-1 depocenter.

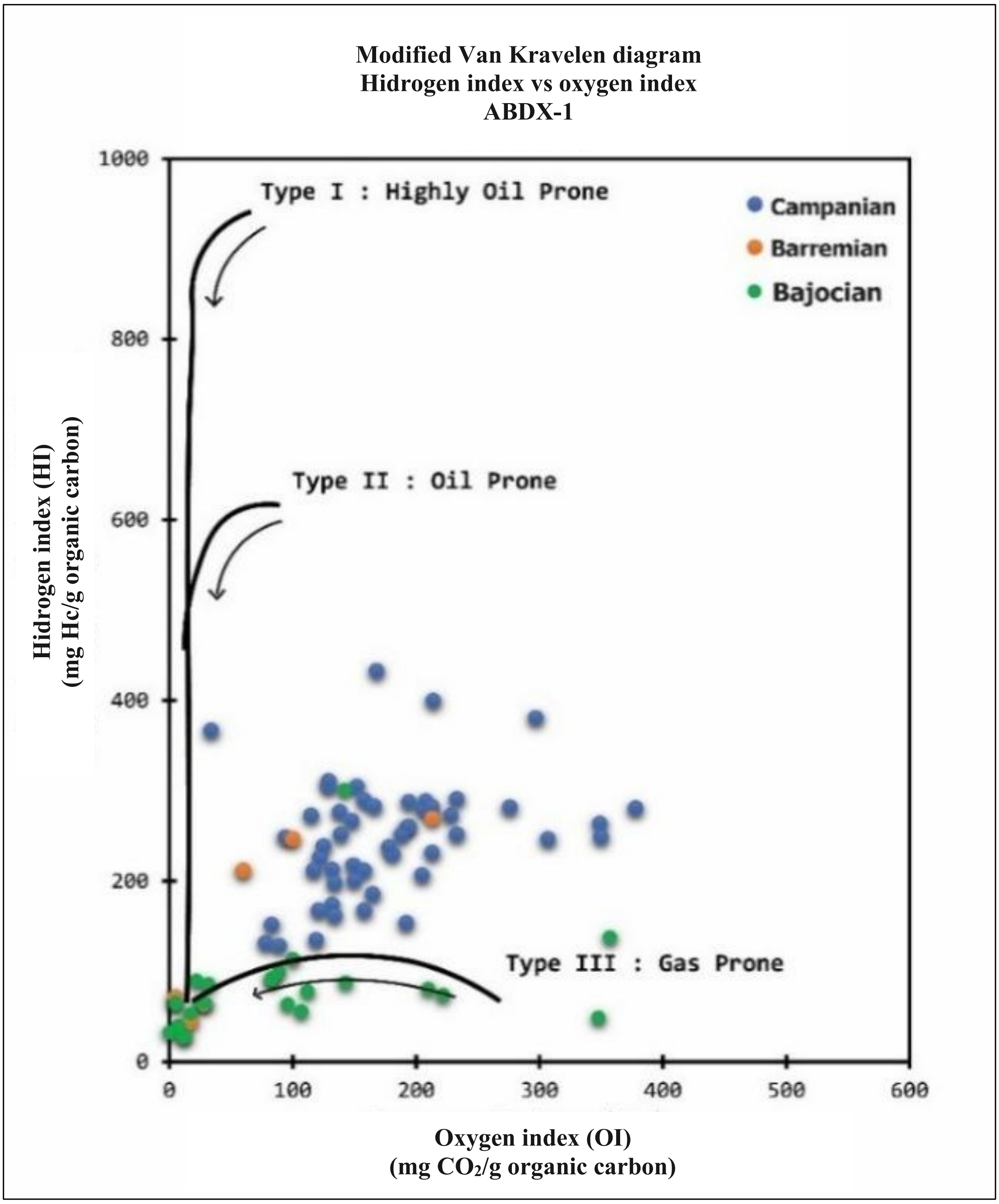

Figure 4. Modified Van Krevelen diagrams (hydrogen Index vs Oxygen Index) for ABDX-1 (Depocenter) showing the distribution of kerogen type across 3 (three) stratigraphic intervals (Campanian, Barremian, and Bajocian). The major samples plot within the Type II-III Kerogen field, indicating mixed oil and gas prone source rock character with predominantly terrestrial-marine organic matter input. This kerogen composition at the depocenter contrasts with more thermally immature or oxidized organic matter observed at structural high areas.

Thermal maturity and burial history

The 1D basin modeling results highlight a significant disparity in thermal evolution, driven by the varying burial histories across the basin. To ensure the reliability of these results, the models were rigorously calibrated against observed vitrinite reflectance (Ro) and corrected bottom hole temperature (BHT) data, as illustrated in the calibration plots for representative wells (Figure 5). This validation process demonstrates a robust correlation between the calculated maturity profiles and actual well data.

Table. 1 Summary of geochemical properties and source rock potential for the exploration wells in the Arafura Basin.

WELL	AGE	TOC (wt%)	S1	S2	Tmax	HI	OI
ABDX-1	Maastrichtian	0.72	0.45	2.27	362	251	154
ABDX-1	Campanian	0.92	0.75	2.71	407	248	176
ABDX-1	Albian	0.69	-	-	-	-	-
ABDX-1	Barrenian	2.10	1.25	2.50	453	152	71
ABDX-1	Bajocian	1.82	0.62	1.60	456	79	91

WELL	AGE	TOC (wt%)	Tmax	HI	OI
BRX-1	Albian	0.74	380	58	59.14
BRX-1	Barrenian	1.83	423	39	10
BRX-1	Berriasian	0.66	-	-	-
BRX-1	Oxfordian	0.48	418	39	10
BRX-1	Callovian	0.5	381	50.5	53

WELL	AGE	TOC (wt%)	S1	S2	Tmax	HI
KBX-1	Langhian	0.28	0.03	0.25	409	63
KBX-1	Chattian	0.19	0.07	0.55	348	571
KBX-1	Late Rupelian	0.19	0.33	-	233	-
KBX-1	Campanian	0.13	0.13	0.09	396	392
KBX-1	Albian	0.39	0.03	0.22	425	93
KBX-1	Barrenian	0.19	0.05	0.30	504	347

WELL	AGE	TOC (wt%)	S1	S2	Tmax	HI
KLX-1	Piacenzian	12.44	0.23	53.88	428	174
KLX-1	Zanclean	0.83	0.04	0.90	429	117
KLX-1	Langhian	0.66	0.05	0.71	429	106
KLX-1	Chattian	0.68	0.02	0.41	429	60
KLX-1	Campanian	0.47	0.08	0.43	428	91
KLX-1	Albian	-	0.08	8.35	432	61
KLX-1	Barrenian	4.77	0.10	7.89	434	77
KLX-1	Loppgian	4.48	0.29	28.17	441	92

WELL	AGE	TOC (wt%)	S1	S2	Tmax	HI
BBX-1	Piacenzian	6.48	0.17	4.50	431	54
BBX-1	Zanclean	1.15	0.14	1.87	429	171

Parameter Definitions:
TOC (wt%)= Total Organic Carbon content (weight percent); S1 = Free hydrocarbons (mg hydrocarbon/g rock); S2= Hydrocarbons released by pyrolysis (mg hydrocarbon/g rock); Tmax = Temperature at maximum S2 hydrocarbon yield (°C); HI= Hydrogen Index (S2 × 100 / TOC);OI = Oxygen Index (S3 × 100 / TOC).

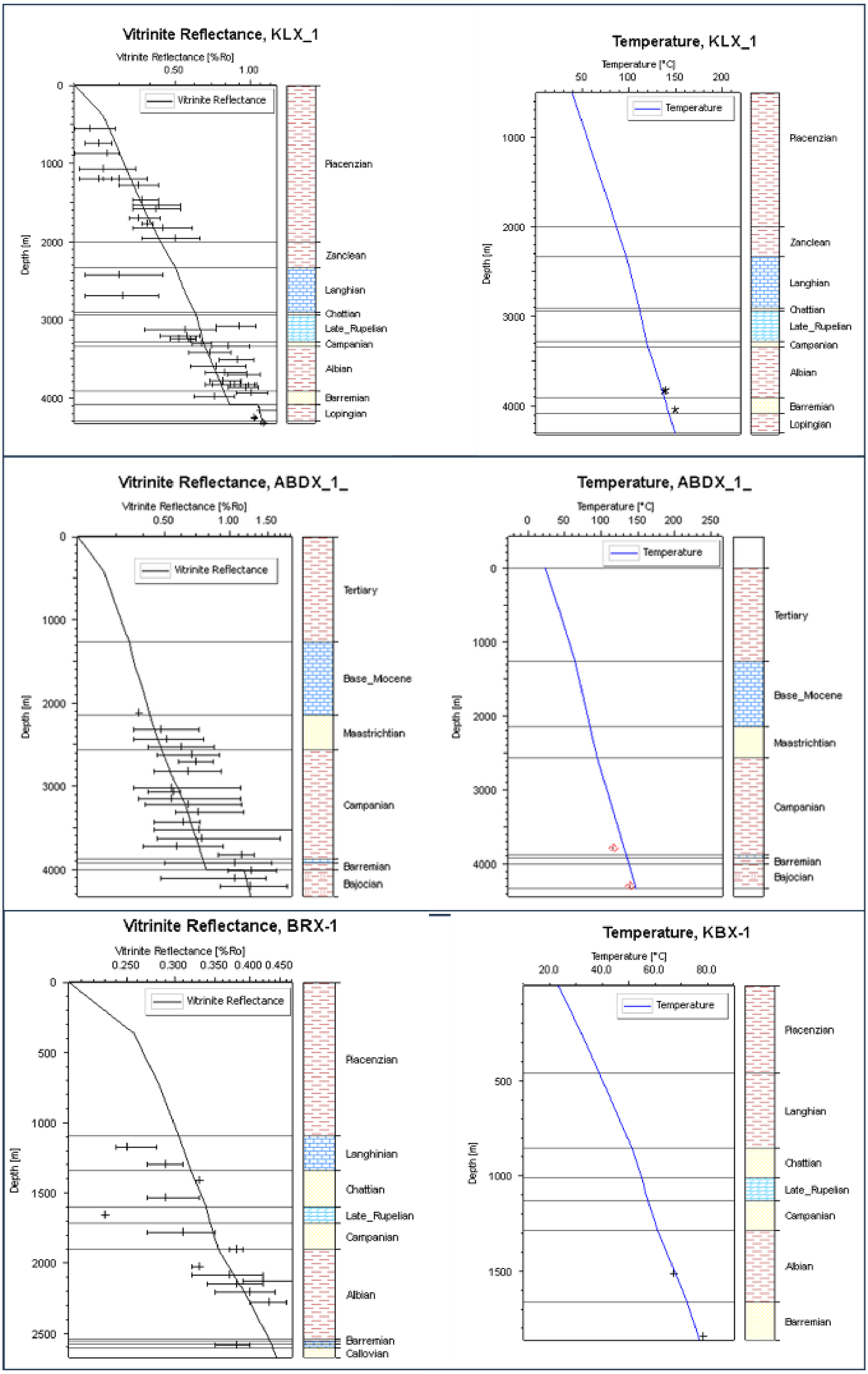

Figure 5. Thermal model calibration results for representative wells in the Arafura Basin. The left panel displays measured vitrinite reflectance (Ro) data versus the calculated EASY%Ro maturity profiles. The right panels show measured bottom hole temperature (BHT) or DST data (symbols) compared against the simulated temperature gradients. The high-fidelity correlation observed in both depocenter wells (KLX-1 and ABDX-1) and structural highs (BRX-1 and KBX-1) validates the reconstructed burial and heat flow history used in this study.

Effective Hydrocarbon Kitchens (Depocenter Areas) In the northern and southern depocenters (Wells KLX-1 and ABDX-1), the modeling reveals an aggressive maturity trend rapid increase in maturity toward the deeper sequences. At Well KLX-1, the Permian (Lopingian) source rock has reached the Peak Mature stage, with Ro averaging 0.81% and Tmax averaging 442°C. This advanced maturation is attributed to the "thermal blanket effect" caused by a rapid surge in Neogene sedimentation rates, which exceeded 1,000 m/Ma during the Piacenzian-Zanclean. Similarly, in the southern depocenter (Well ABDX-1), the Bajocian interval has reached Late Mature status (avg. Ro

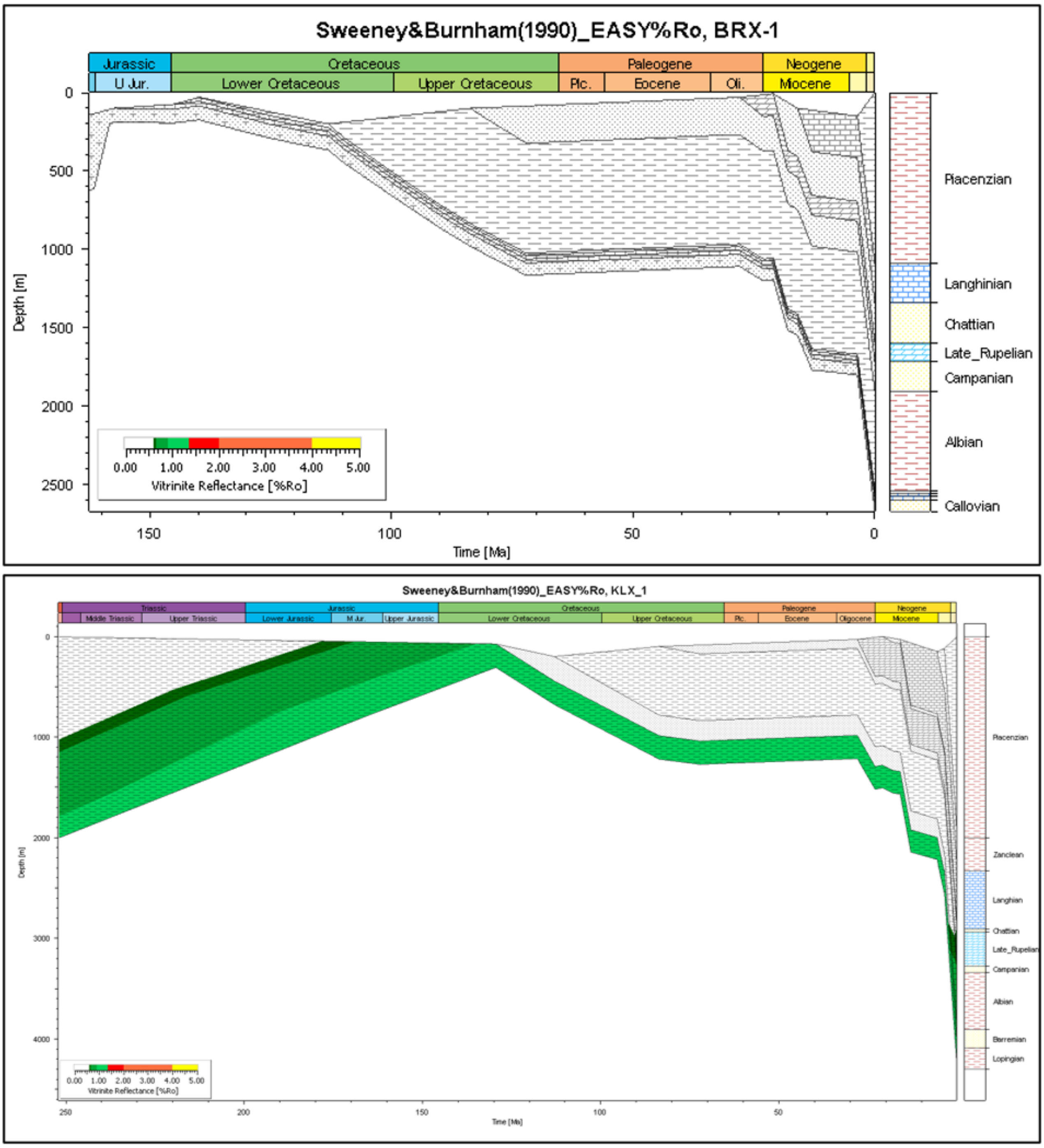

Figure 6. Burial history and thermal maturity profiles. Bottom: Well KLX-1 (Northern Depocenter) showing deep Neogene burial entering the oil window. Top: Well BRX-1 (Structural High) showing insufficient burial and immature status.

1.15; Tmax 456°C), entering the wet gas window. This high thermal stress is confirmed because of elevated syn-rift heat flow (~110 mW/m²) during the Jurassic (~165 Ma) combined with substantial Neogene burial.

Non-Generative Domains (Structural Highs) In stark contrast, wells located on structural highs (BRX-1, KBX-1, and BBX-1) exhibit immature profiles throughout the drilled sections. Calibration for Well BRX-1 (Figure 6) shows the Albian interval at a low maturity level (avg. Ro 0.38%). These areas remained thermally stagnant due to insufficient overburden thickness and lower paleo-heat-flow regimes compared to the actively rifted depocenters. Consequently, these structural elements are categorized as non-generative zones, where any potential hydrocarbon accumulation must rely on lateral migration from the adjacent kitchens.

Timing of generation and tectonic control

The reconstruction of thermal history reveals that the timing of hydrocarbon generation is strongly controlled by the Neogene tectonic events, specifically the Melanesian Orogeny. The Transformation Ratio (TR) analysis indicates an dramatic increase in hydrocarbon conversion during the Pliocene-Pleistocene. The Lopingian interval shows a TR of 85.86% at present day, confirming it has passed peak generation. This was triggered by a rapid surge in sedimentation rates, which exceeded 1,000 m/Ma during the Piacenzian -Zanclean, acting as a thermal blanket to push source rocks into the oil window. The Bajocian source rocks entered the early oil window as early as the Jurassic (~165 Ma) due to high syn-rift heat flow (~110 mW/m²). However, the bulk generation mass significantly spiked only in the late Neogene. The Barremian and Campanian intervals also show active expulsion phases occurring primarily in the Quaternary.

The implication of these findings is critical for exploration strategy. The structural highs are proven indicated? discovered? To be non-generative due to the lack of thermal stress. Therefore, hydrocarbon accumulation in prospects located on these highs (such as the areas surrounding BRX-1 or KBX-1) must rely entirely on lateral migration from the active kitchens in the adjacent northern and southern depocenters.

CONCLUSION

The study confirms that potential source rocks in the Arafura Basin are stratigraphically distributed across two mains tectonic megasequences: the Permian-Jurassic syn-rift sequence (Lopingian and Bajocian sequences), and

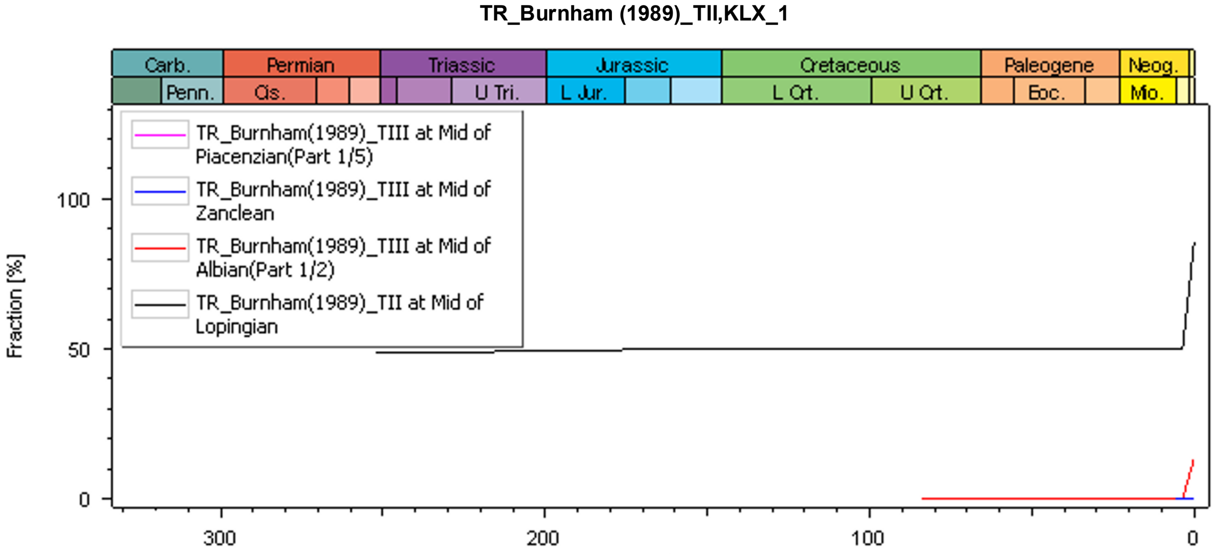

Figure 7. Transformation Ratio (TR) chart for the Permian interval in Well KLX-1. Note the rapid increase in TR reaching >85% during the Pliocene-Pleistocene, triggered by the Melanesian Orogeny.

the Cretaceous passive margin sequence (Campanian and Albian sequences). The Permian (Lopingian) and Jurassic (Bajocian) intervals in the depocenters demonstrate the highest organic richness and generative potential.

A critical thermal maturity contrast exists between the basin's structural elements. The northern and southern depocenters are proven as active generative kitchens : Well KLX-1 (North) has reached Peak Mature status with a Transformation Ratio (TR) exceeding 85% in the Permian interval, while Well ABDX-1 (South) has entered the late-mature to wet-gas window in the Jurassic sequence. Conversely, structural highs (wellsBRX-1, KBX-1, and BBX-1) remain thermally immature and non-generative due to insufficient sedimentary overburden. Consequently, prospect in the structural highs is entirely contingent upon effective lateral migration pathways from these adjacent active depocenters.

Prospects located on Arafura Basin structural highs (such as BRX-1, KBX-1, and BBX-1 areas) are entirely contingent upon lateral migration from active hydrocarbon kitchens in adjacent depocenters, requiring detailed analysis of migration pathways and seal integrity—critical elements that are often underestimated in frontier basin exploration risk assessment, particularly in tectonically complex regions where structural controls on petroleum system components remain inadequately characterized.

The timing of hydrocarbon generation is intrinsically linked to the Melanesian Orogeny. Although early generation in the southern sector (ABDX-1) began as early as the Jurassic, the bulk hydrocarbon expulsion across the generation mass basin was triggered primarily in the Late Neogene (Pliocene-Pleistocene). Despite early generation in the southern sector (ABDX-1) during the Jurassic, the main phase of hydrocarbon expulsion across the basin's kitchens was triggered in the Late Neogene. This event was driven by extreme sedimentation rates exceeding 1,000 m/Ma in the northern sector which provided the critical thermal stress to push Mesozoic and Paleozoic source rocks into the main oil and gas windows within a recent geological timeframe. This late-stage expulsion is highly favorable for the preservation of hydrocarbons in Neogene traps.

The timing of hydrocarbon generation in the Arafura Basin is intrinsically linked to the Melanesian Orogeny-induced stress regime, with early generation in the southern sector (Jurassic rifting phase with ~110 mW/m^2 heat flow) followed by bulk expulsion in the Late Neogene (Pliocene-Pleistocene), driven by extreme sedimentation rates exceeding 1,000 m/Ma—a scenario consistent with integrated petroleum system analyses conducted in other frontier basins of eastern Indonesia.

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GLOSSARY OF TERMS AND SYMBOLS

System	Definition	Unit
1D	One-Dimensional Basin Modeling	technique
ABDX-1	Exploration well in southern depocenter, Arafura Basin	well name
API	American Petroleum Institute	standard/organization
BHT	Bottom Hole Temperature	°C
BRX-1	Exploration well in structural high, Arafura Basin	well name

CO_2	Carbon dioxide	chemical compound
DST	Drill Stem Test	downhole measurement
EASY%Ro	Empirical kinetic model for vitrinite reflectance simulation (Sweeney & Burnham, 1990)	kinetic model
HF	Heat Flow	mW/m^2
HI	Hydrogen Index	mg/g TOC
KBX-1	Exploration well in structural high, Arafura Basin	well name
KLX-1	Exploration well in northern depocenter, Arafura Basin	well name
LEMIGAS	Testing Center for Oil and Gas LEMIGAS	research institute
m/Ma	Meters per million years (sedimentation rate)	unit
Ma	Million years ago,	time unit
mg/g	Milligrams per gram	unit
mgHC/g	Milligrams of hydrocarbon per gram of rock	unit
mW/m^2	Milliwatts per square meter	unit
OI	Oxygen Index	mg CO_2/g TOC
PWD	Paleowater Depth	m
Ro	Vitrinite Reflectance (% maturity)	%
S1	Free hydrocarbons (Rock-Eval pyrolysis parameter)	mgHC/g rock
S2	Hydrocarbons released by pyrolysis of kerogen	mgHC/g rock
S3	Carbon dioxide released by pyrolysis of organic matter	mg CO_2/g rock
SWIT	Sediment-Water Interface Temperature	°C

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