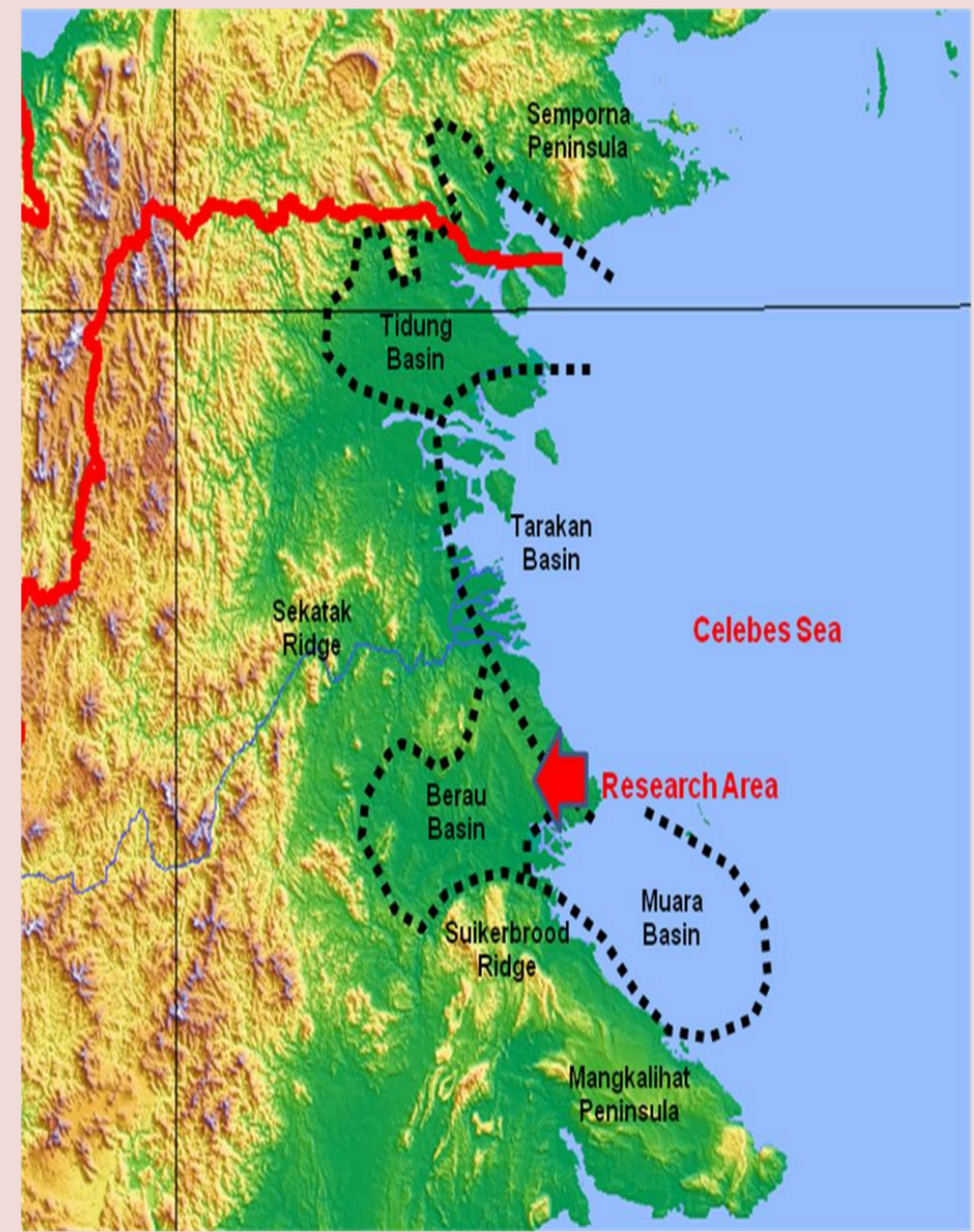




ABSTRACT. The coal maceral identification have been undertaken to determine the petrographic characteristics of the Sajau Formation coal in the Berau Basin, East Kalimantan and their depositional environment. The coal bearing Sajau Formation are represented by clays, carbonaceous clay, sandstones, sandy and lime clays and up to 13 coal seam. Mostly of coal is composed of fine- to coarse grained xylitic to detritic fragments with light- to dark-brown colour, mounted by dull groundmass. The Sajau coal belong to the lithotype category of matrix soft brown coals, immature stage and at low phase of coalification represents a transition from peat to lignite. The microscopic investigations revealed the coal is characterized by great maceral diversity, which dominated by huminite group, which constitute between 7–96.5 vol.% of the coal; following by liptinite macerals (mean 12,57 vol. %) and inertinite approximately 5.38 vol. %. The coal petrological properties, as well as the indices of the coal facies shown low TPI, low VI, high GI and high GWI, reveal that the coal was deposited under rethrophic regime continuously wet limnic to limno-telmatic conditions with occasionally dry season. The coals are a result of deposition of either from the dominantly herbaceous vegetation, mixed with woody trees, forming swamp type paleomire. Presence of pyrite with fibroidal structure indicated enhanced activity of sulphate-reducing bacteria, probably related to carbonate and sulphate-rich waters in the basin during peat formation. The varied palynology indicated most of coal were deposited in mire environment predominantly forest swamp. It can also be concluded that the Seam A - G coal was deposited in fluvatile to upper delta system and Seam H – M on lower delta plain environment.

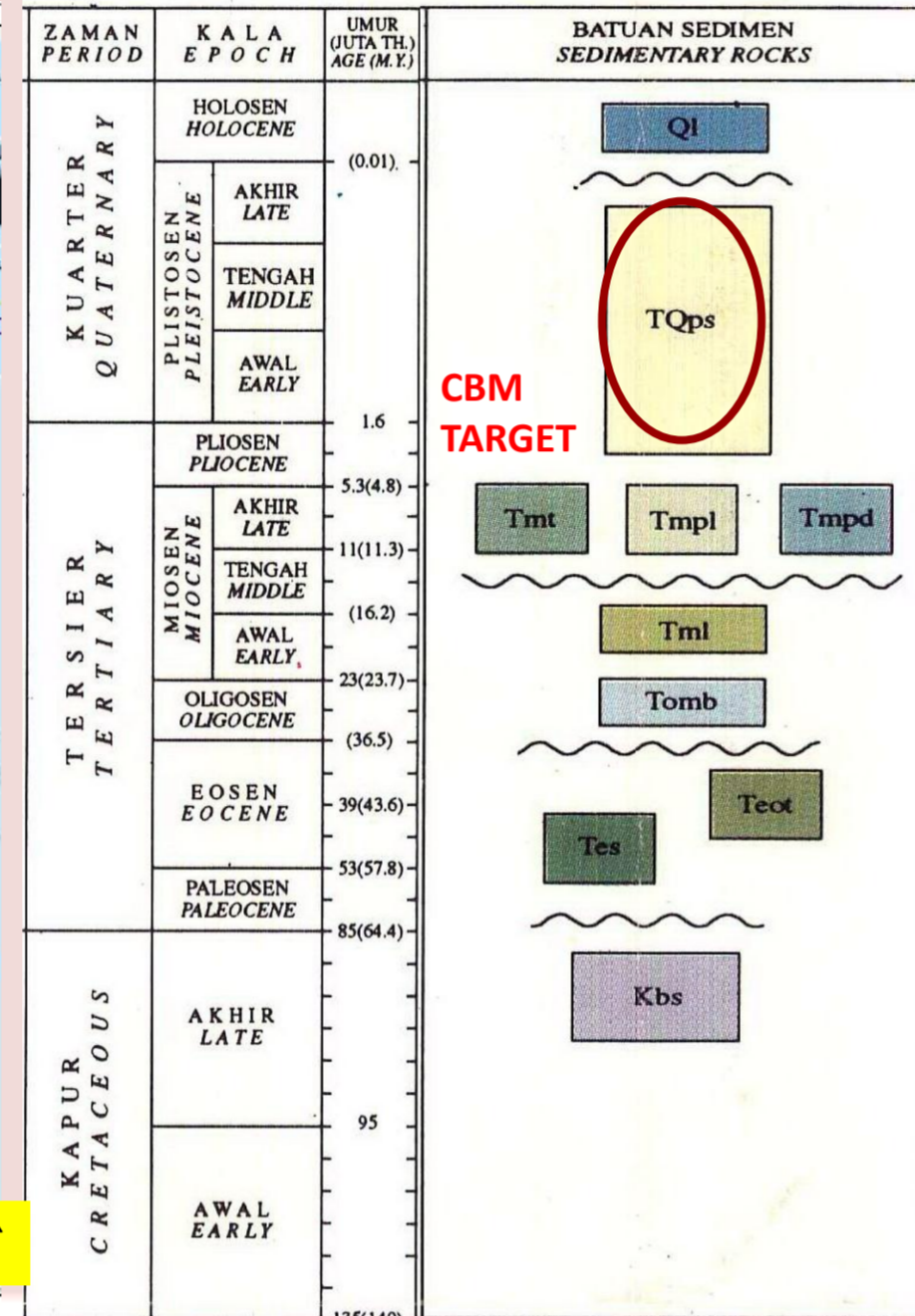
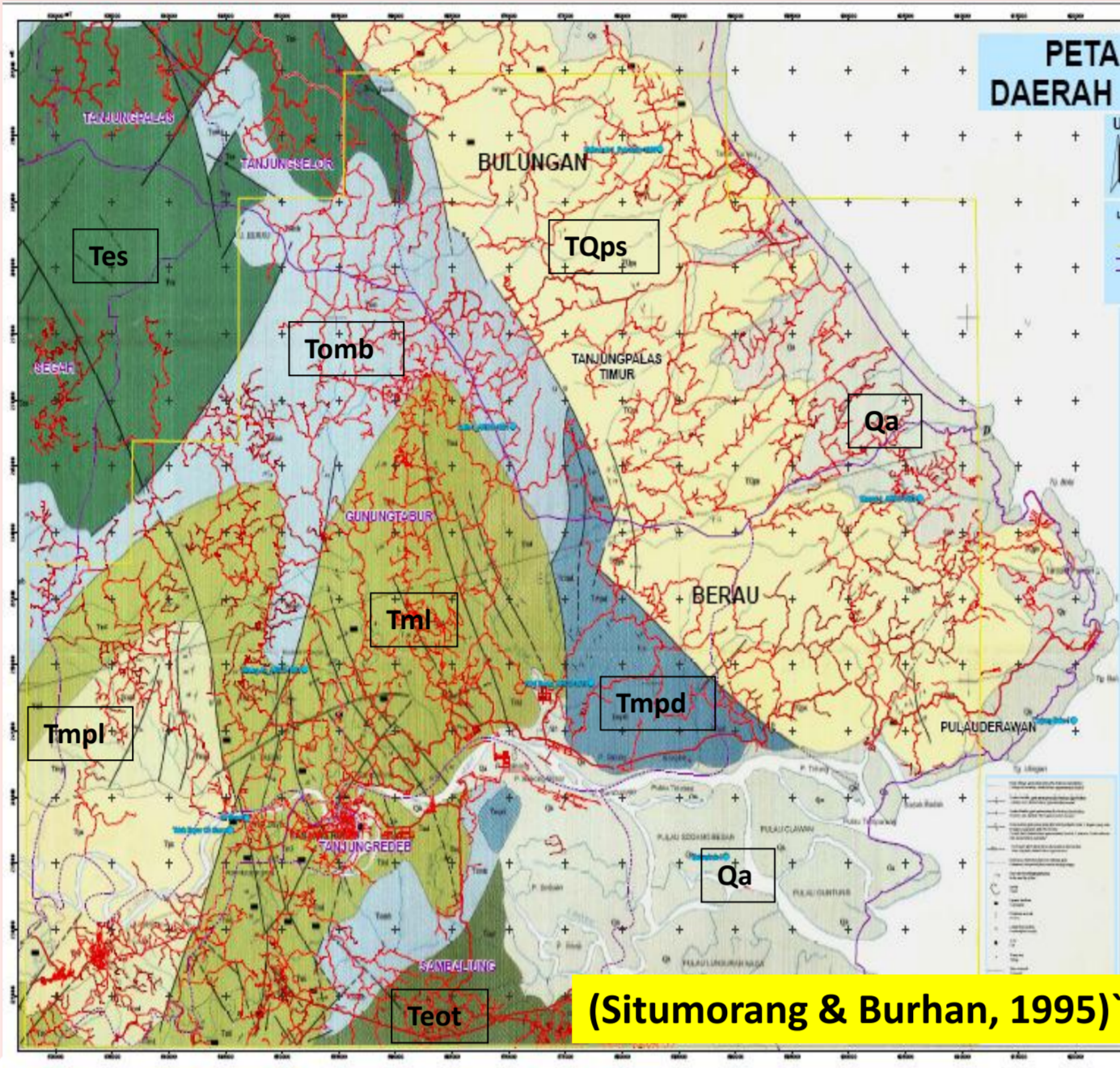
Key words: Macerals, coal indices, depositional environment, Sajau coal, Berau Basin.

Research Area



Introduction

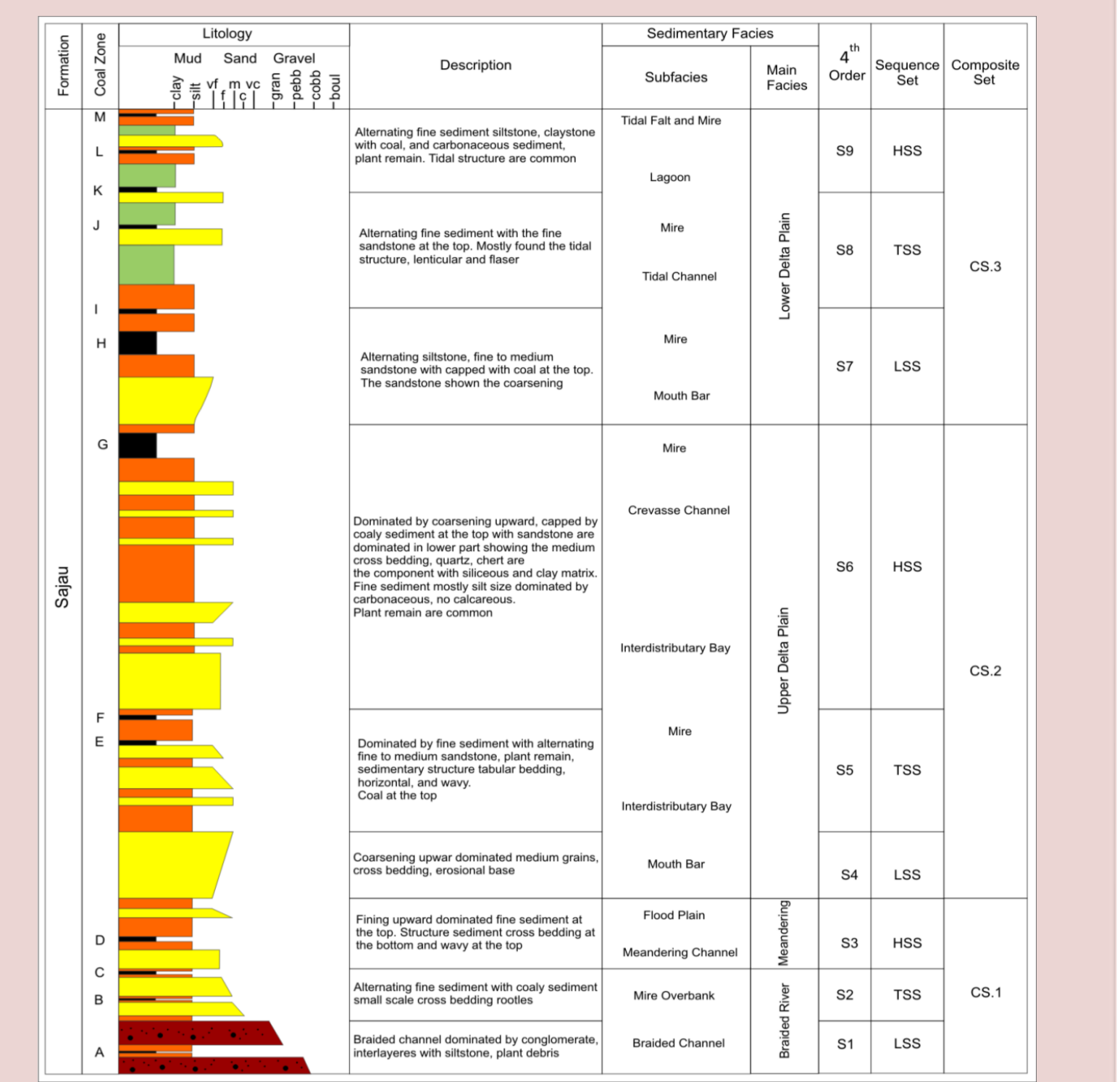
The Berau Basin which located in northeastern Kalimantan is one of major coal basin in Indonesia having economic coal deposit. Beside the coal mining activities; there are also most of coal bed methane exploration activities in the Basin, have been focused on the coal of Pliocene sediments of Sajau Formation. The purpose of the present study is to assess the variations in the microscopic constituents of coals of Sajau in Berau Basin to know the genetic reasons and depositional environment of Sajau Coal in Berau Basin



- **Qa** : Alluvium
- **TQps** : Sajau Formation - Pleistocene (fluvio-deltaic deposits - alternations of claystone, siltstone, and sandstone, minor coal seams)
- **Tmpd** : Domaring Formation - Late Miocene-Pliocene (swamp-litoral deposits - coralline limestones, chalky limestones)
- **Tmpl** : Labanan Formation - Late Miocene-Pliocene (fluvial deposits - polyimic conglomerate, sandstones)
- **Tml** : Latih Formation - Early-Middle Miocene (delatic deposits - quartz sandstones, claystones)
- **Tomb** : Birang Formation - Oligo-Miocene (shallow marine deposits - marl, limestones, tuff, sandstones)
- **Teot** : Tabalar Formation - Eo-Oligocene (fluvial-shallow marine - marl, shale, limestone, sandstone)
- **Tes** : Sembakung Formation - Eosen (marine deposits - claystones, siltstones, sandstones)

Sajau Coal Sequence Stratigraphy

Thickest coal seams are attributed to High stand Sequence Set (H SS) and Transgressive System Sequence Set (TST owing to the optimum preservation



Materials and Methods

Coal samples were collected from five drilling locations in Berau Basin. The coal from the Sajau Formation. From each coal core, about 2.5 - 3 kg of coal samples were collected. The samples were crushed to -18 mesh size for petrography and 70 mesh size for proximate analysis.

The maceral and huminite reflectance were simultaneously carried out on polished block using incident light Leica MPV coal petrography microscope in CoreLab, Jakarta, Indonesia. In maceral and microlithotype analysis; the point counting for each sample more than 500 counts were taken. The methodology given by Stach's, 1982 was followed and the terminologies for huminite macerals given by ICCP 2005 and that of inertinite given by ICCP, 2001. The reflectance measurements were taken on huminite type macerals and at least 30 - 50 counts were made on each sample.

Coal Indices

$$TPI = \frac{Htel + SFus + Fus}{Hdet + Hcol + Idet}$$

$$GI = \frac{Huminite}{Inertinite}$$

$$GWI = \frac{Htel + Hdet + Mineral Matter}{Htel}$$

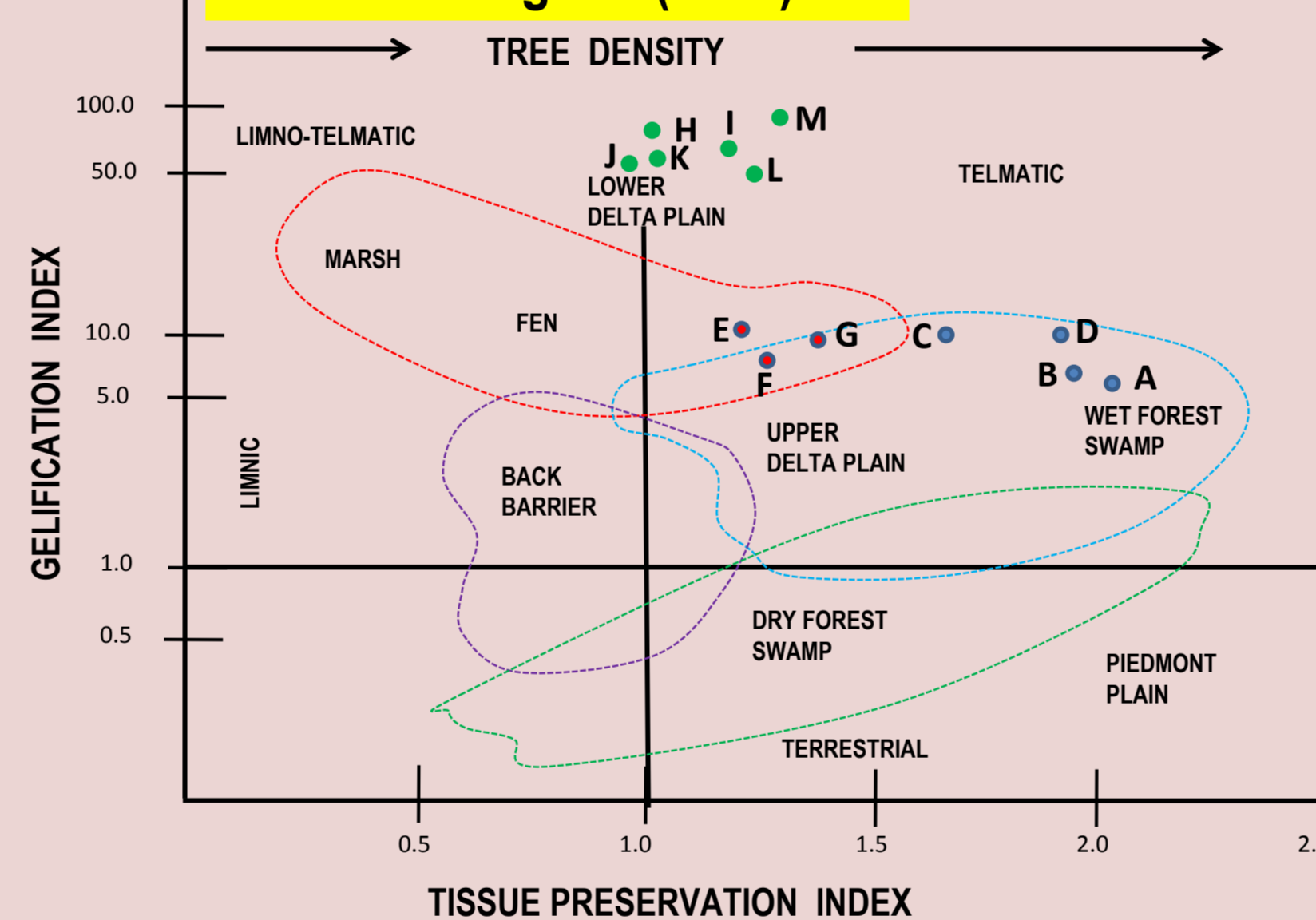
$$VI = \frac{Htel + Fus + SFus + Sub}{Hdet + Id + Lip}$$

The palynological investigations applied to show the palynofloral variations both vertical or horizontal characteristics. These variation useful to identified the topogeny and ombrogeny mire characteristics.

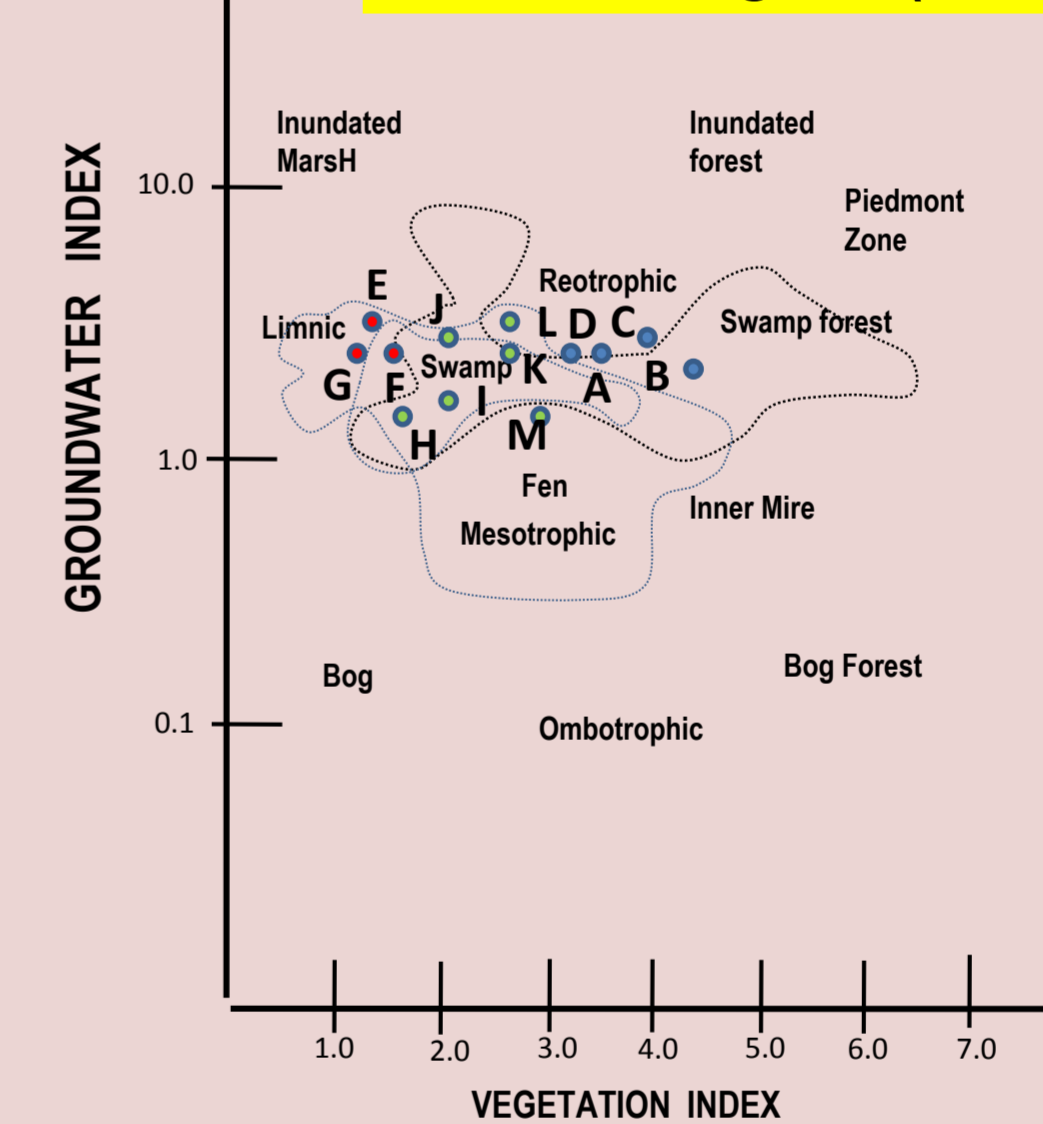
Result : Petrography of Coal Samples of Sajau Formation

SAMPLE NOS	COAL SEAM												
	A	B	C	D	E	F	G	H	I	J	K	L	M
HUMINITE	70.7	80	79.9	80.2	96.5	79.6	80	87.14	81.84	89.79	68.18	85.92	90.12
Humotellinite	20.2	29.2	21.4	20.2	28.2	18.1	30.4	27.88	9.82	8.08	9.55	8.59	9.91
Humodetrinite	15.1	16.2	19.1	24.8	28.2	11.3	15.4	9.59	25.37	25.14	15.00	22.34	28.84
Humocolinite	35.4	34.6	39.4	35.2	40.1	50.2	34.2	49.67	46.65	56.57	43.64	54.99	51.37
LIPTINITE	10.10	10.20	11.40	11.40	7.90	11.70	11.60	11.46	16.96	8.61	30.52	12.88	8.68
INERTINITE	9.00	9.80	8.60	8.30	9.80	8.30	8.30	1.40	1.20	1.60	1.30	1.20	1.20
GI	7.86	8.16	9.29	9.66	9.85	9.59	9.64	62.24	68.20	56.12	52.45	71.60	75.10
TPI	2.12	1.80	1.68	1.88	1.24	1.32	1.46	1.06	1.24	0.92	1.02	1.34	1.38
Mean Ro	0.44	0.40	0.46	0.37	0.34	0.34	0.29	0.26	0.29	0.27	0.26	0.28	0.30

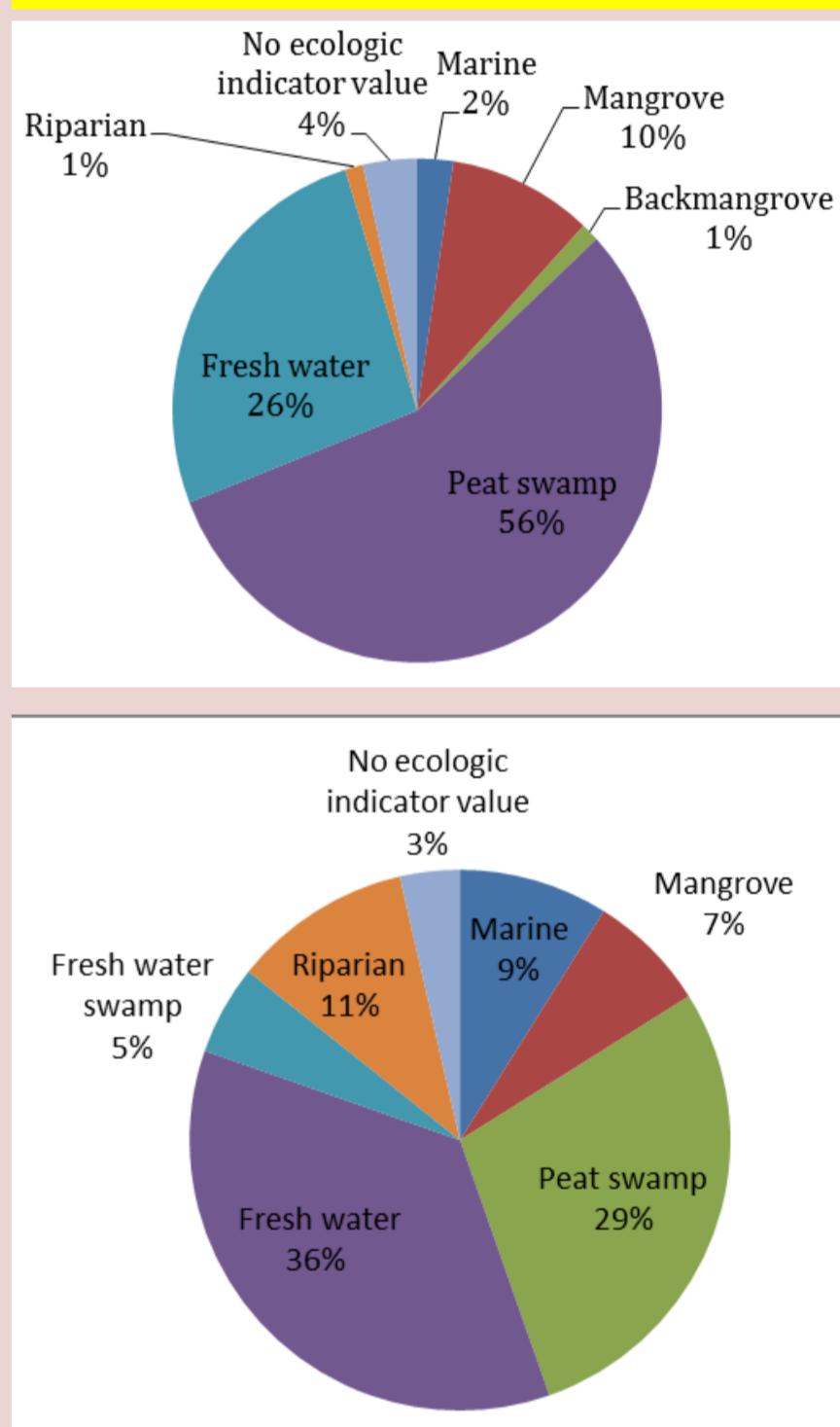
Diessel's Diagram (1986)



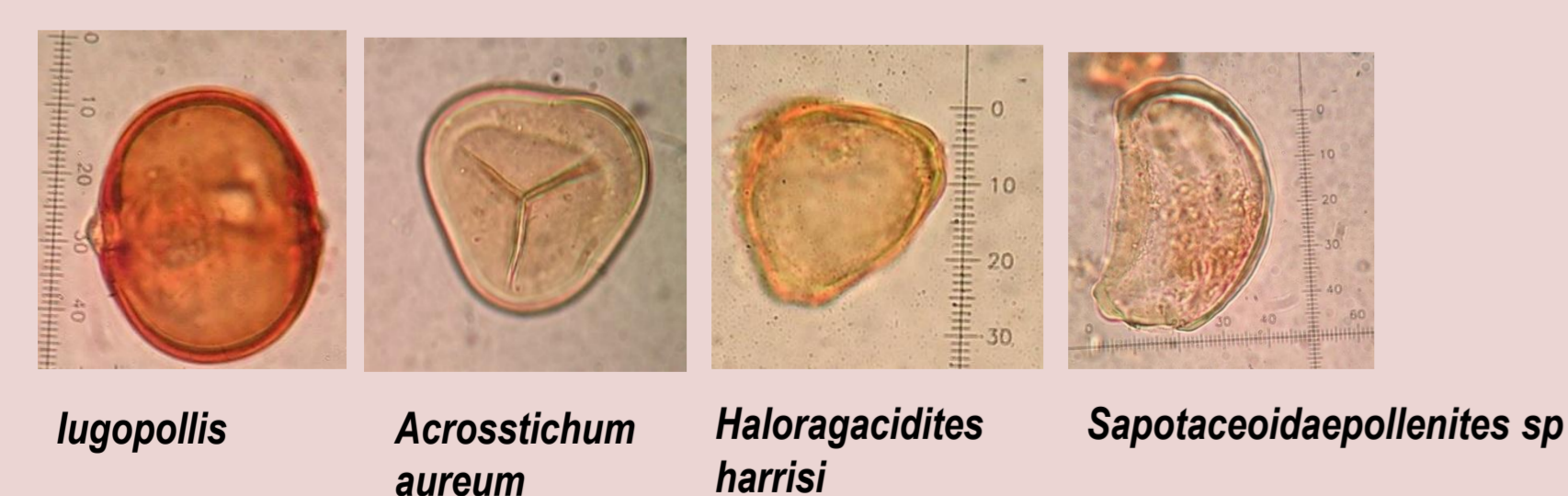
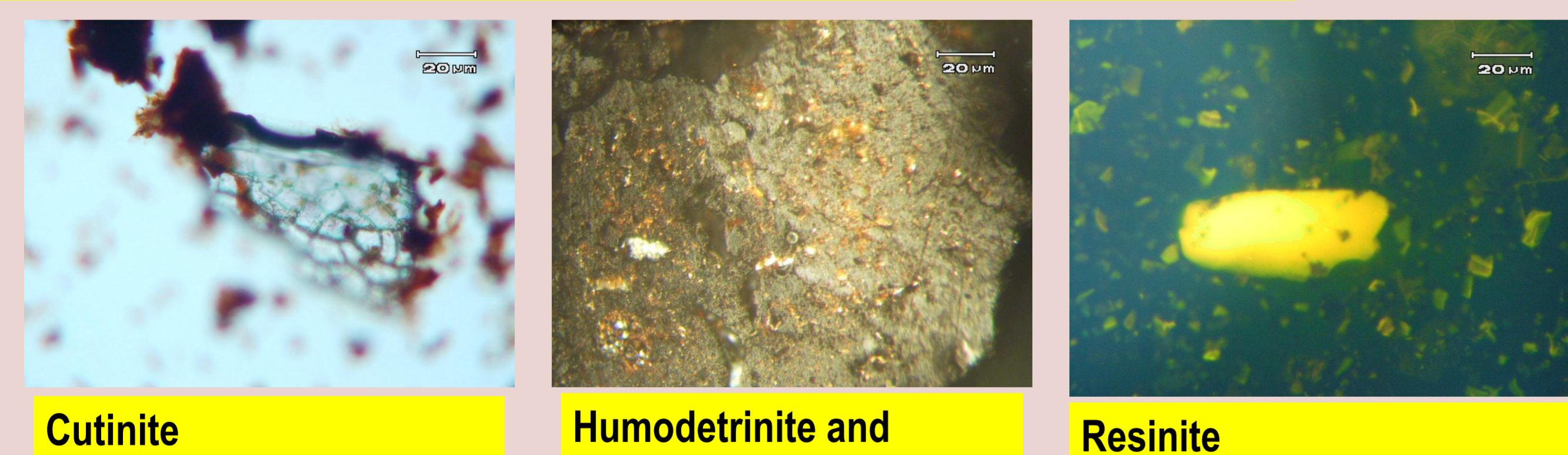
Calder's Diagram (1981)



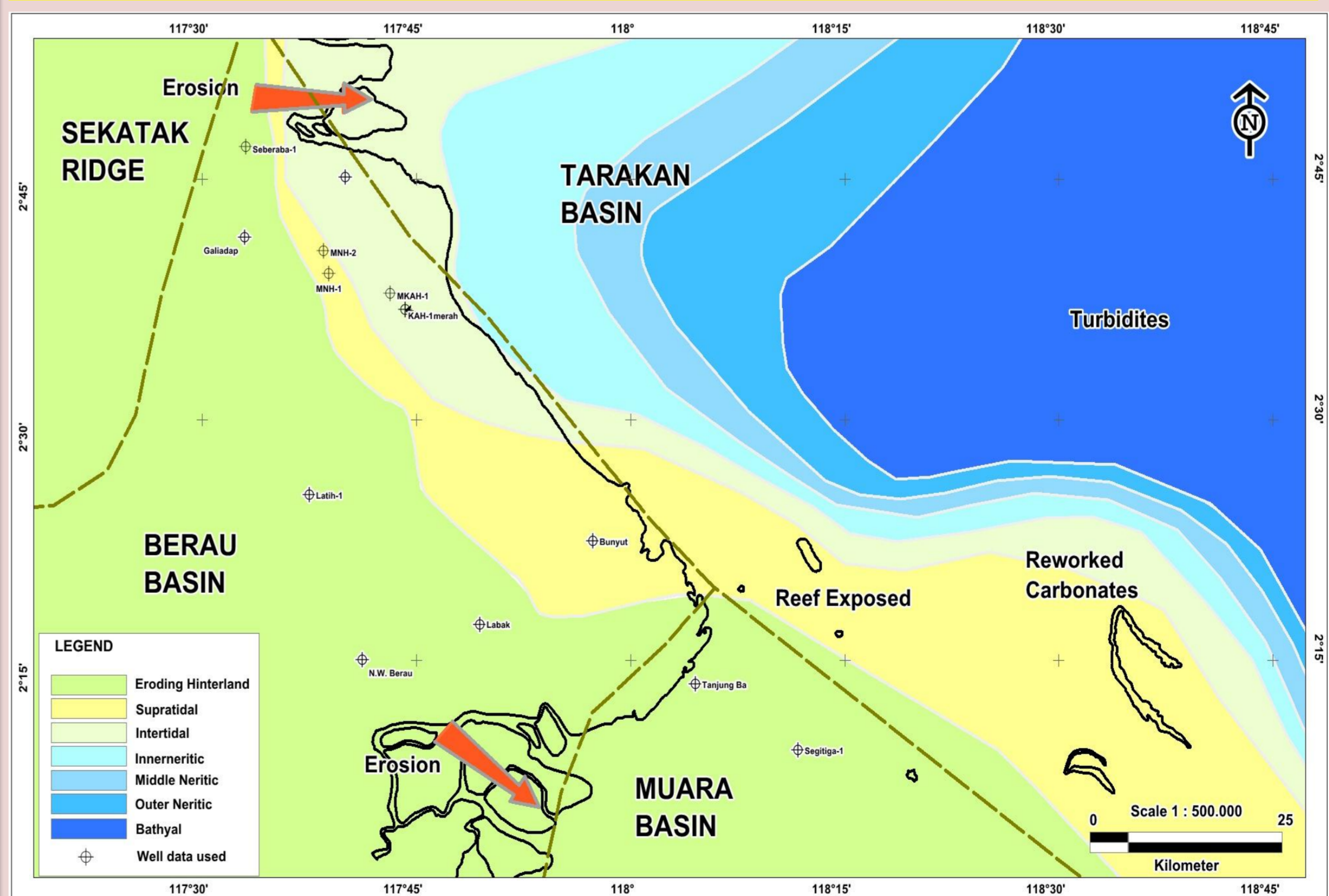
Palynology Distribution of Coal Sajau Formation



Microphotographs of macerals and Pollen in the Sajau coal



Paleogeography Of Late Pliocene (2.09 Ma)



Conclusion

- 1) The Sajau coal belong to the lignite to sub bituminous coals. Mean Huminite reflectance (Rm); given coal is immature stage.
- 2) The petrography inspection reveal that the coals are exceedingly rich in macerals from Huminite group following by the same proportional of liptinite group and inertinite group. In huminite group; the humocollinite is predominantly than other structured macerals in most cases have different values. Sporinite, liptodinit, cutinite and resinite, were main contributor of sub-group Liptinite macerals were identified by using fluorescent light. The inertinite macerals are predominantly of inertodetrinite with other maceral fusinite, subfusinite and micrinite were very low.
- 3) The varied palynology assemblage suggested that the coal within a number of mire environment predominantly in a forest swamp
- 4) For reconstruction of the paleoenvironment the coal maceral contents were arranged in TPI, GI, GWI and VI maceral indices, concurrent along with the pollen distribution. Mostly of the samples have low TPI, low VI, high GI and high GWI which their indices reveal that the coal was deposited under rethrophic regime continuously wet limnic to limno-telmatic conditions with occasional dry season. The coals are a result of deposition of either from the dominantly herbaceous vegetation mixed with woody trees (coal seam A - G which deposited in fluvatile system to upper delta plain) while the coal seam H - L dominated by maceral derived from woody tree (Lower delta plain). There are tendency the gradually change from the reothropy mire to mesotrophi - oligotrophi

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