CHAPTER 6
CONCLUSIONS

From maceral distribution, it can subdivided into liptinite zone, exsudatinite zone, vitroliptinite zone, liptinite mainly alginite zone and vitrinite zone. In liptinite zone, the maceral in vitrinite group found only gelinite and attrinite fluctuated in range, generally less than 20% in some depth higher than this. The macerals in liptinite group such as resinite, amber, suberinite and alginite are common, each consists less than 30%, liptodetrinite is the richness maceral, up to 50% whereas the other macerals in this group are rare. The maceral in inertinite group found only sclerotinite in some depth in rare amounts. In exsudatinite zone, only exsudatinte was found, the other macerals are very rare. In Vitroliptinite, the maceral in vitrinite group usually are gelinite and attrinite found less than 20%. The macerals in liptinite group, exsudatinite are dominated, up to 50% whereas alginite and liptodetrinite are vary but less than 30% and the other macerals are rare. In the alginite zone, alginite A (?) and exsudatinite are dominated macerals. In vitrinite zone, attrinite and gelinite are dominated macerals and found only exsudatinite associated.

Vitroliptinite and vitrinite are vertically abundant in the lower sequences whereas exsudatinite dominates in the middle sequences. Liptinite is the most abundant in the upper sequences. Laterally, exsudatinite zone show the thickening trend towards the basin center whereas the vitroliptinite and vitrinite zones show the opposite trend, being thinning towards the basin center. The liptinite zone, on the other hand, shows a uniform thickness (Figure 6.1).

Liptinite zone was found in the gray claystone and coal or coaly shale, possibly deposited in the deltaic plain or transgressive marginal

marine environments in sequence 5 and the uppermost part of sequence 4. Exsudatinite zone was dominanted in the reddish brown claystone of sequence 4, probably deposited in the floodplain environment. Vitroliptinite and vitrinite zones were found in the reddish brown claystone, coal to coaly shale and sandstone in the lower part of sequence 4. The vitroliptinite and vitrinite zones were also found in the lagoonal deposits in sequence 3 as well as in the floodplain or deltaic plain deposits in the upper part of sequence 2 (Table 6.1).

Liptinite maceral group found in sequence 5 and upper sequence 4 is too young, hence still immature with regard to the oil generation window. These sequences, therefore, unlikely to be the effective source rocks. The liptinite maceral deposited in upper sequence 2, sequence 3 and lower sequence 4 are mature. It can be an effective source rocks contributing to the generation of oil and gas in the Pattani Basin.

The lithology and degree of organic maturation influence the appearance of maceral groups. However some unidentified alginite which were found in F well between –5910 ft to -6424 ft and in H well between depth down to –8747 ft are seem to be found unique only in the Pattani Basin yet to be more investigation.

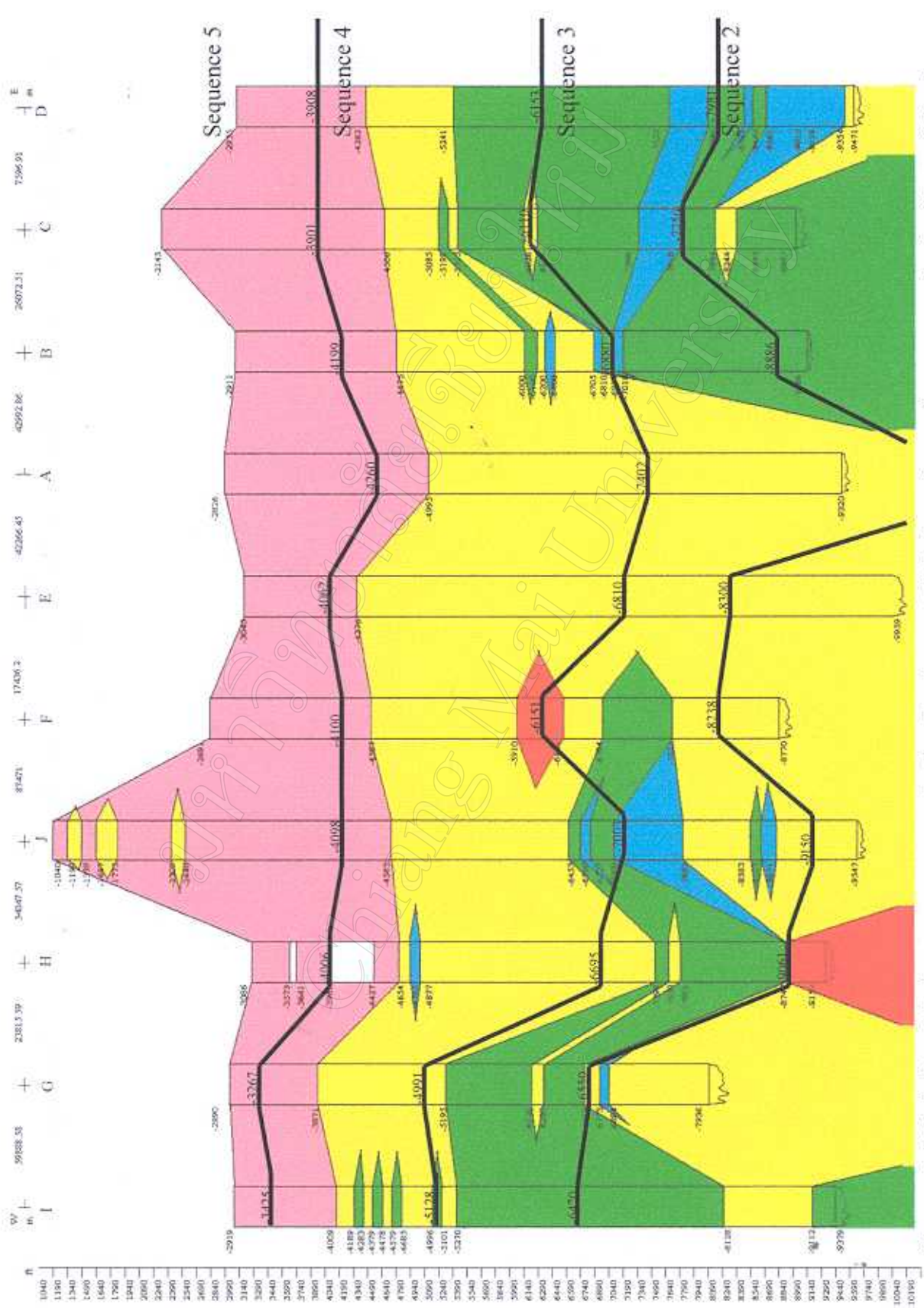

Figure 6.1 Relationship between macerals distribution and lithology in each sequence in the Pattani Basin, in east - west direction.

Table 6.1 Conclusion the relationship between lithology and maceral distribution in the Pattani Basin

Well Name	sequence	Lithology from cutting sample		Macerals distribution	
		depth (ft)	lithology	depth (ft)	maceral zone
East Graben A	5	-2826 to -4260	gray clay 85-95%. coal or coaly shale 5-15%.	-2826 to -4260	Liptinite zone
	4	-4260 to -4889	gray clay 90-95%. coal or coaly shale 5-10%.	-4260 to -4995	Liptinite zone
		-4889 to -7402	gray/brown or reddish brown clay 100%.	-4995 to -7402	Exsudatinite zone
	3	-7402 to >-9320	brown or reddish brown clay	-7402 to >-9320	Exsudatinite zone
B	5	-2911 to -4199	gray clay 70-95%. coal or coaly shale 5-30%.	-2911 to -4199	Liptinite zone
	4	-4199 to -4675	gray clay 85-90%. coal or coaly shale 10-15%.	-4199 to -4675	Liptinite zone
		-4675 to -5509	gray/brown or reddish brown clay 100%	-4675 to -6000	Exsudatinite zone
		-5509 to -6100	brown or reddish brown clay 20-90%, sand 10-80%	-6000 to -6100	Vitroliptinite zone
		-6100 to -6410	brown or reddish brown clay 90-95%, coaly shale 5-10%.	-6100 to -6200	Exsudatinite zone
				-6200 to -6400	Vitrinite zone
		-6410 to -6705	brown or reddish brown clay	-6400 to -6705	Exsudatinite zone
		-6705 to -6880	brown or reddish brown clay 90-95%, coaly shale 5-10%.	-6705 to -6810	Vitrinite zone
				-6810 to -6880	Vitroliptinite zone
	3	-6880 to -7755	brown or reddish brown clay 90-95%, coaly shale 5-10%.	-6880 to -6914	Vitroliptinite zone
				-6914 to -7018	Vitrinite zone
		-7755 to -7860	brown or reddish brown clay 75%, coaly shale 5%. sand 20%.	-7018 to -8886	Vitroliptinite zone
		-7860 to -8886	brown or reddish brown clay 95%, coaly shale 5%.		
	2	-8886 to >-8966	brown or reddish brown clay 95%, coaly shale 5%.	-8886 to >-8966	Vitroliptinite zone
C	5	-2145 to -3901	gray clay 80%, coal or coaly shale 20%.	-2145 to -3901	Liptinite zone
	4	-3901 to -4678	gray clay 80-90%. coal or coaly shale 10-20%.	-3901 to -4506	Liptinite zone
				-4506 to -5085	Exsudatinite zone
		-4678 to -5085	gray/brown or reddish brown clay 100%.	-5085 to -5198	Vitroliptinite zone
				-5198 to -5315	Exsudatinite zone
		-5085 to -6110	brown or reddish brown clay 95%, coaly shale 5%.	-5315 to -6026	Vitroliptinite zone
				-6026 to -6110	Exsudatinite zone
	3	-6110 to -6988	brown or reddish brown clay 95%, coaly shale 5%.	-6110 to -6144	Exsudatinite zone
				-6144 to -7366	Vitroliptinite zone
		-6988 to -7618	brown or reddish brown clay	-7366 to -7618	Vitrinite zone
		-7618 to -7756	brown or reddish brown clay 95%, coaly shale 5%.	-7618 to -7756	Vitroliptinite zone
	2	-7756 to -7994	brown or reddish brown clay	-7756 to -7994	Vitroliptinite zone

Well Name	sequence	Lithology from cutting sample		Macerals distribution	
		depth (ft)	lithology	depth (ft)	maceral zone
			95%, coaly shale 5%.		
		-7994 to -8244	brown or reddish brown clay	-7994 to -8244	Exsudatinite zone
		-8244 to -8493	brown or reddish brown clay 95%, coaly shale 5%.	-8244 to ->8856	Vitroliptinite zone
		-8493 to -8865	brown or reddish brown clay		
		>-8865	brown or reddish brown clay 95%, coaly shale 5%.		
D	5	-2935 to -3908	gray clay 90%, coal or coaly shale 10%.	-2935 to -3908	Liptinite zone
	4	-3908 to -4134	gray clay 90%, coal or coaly shale 20%.	-3908 to -4433	Liptinite zone
		-4134 to -4284	gray/brown or reddish brown clay 90%, coaly shale 10%.		
		-4284 to -4433	gray/brown or reddish brown clay 80%, sand 20%.		
		-4433 to -5117	gray/brown or reddish brown clay 100%.	-4433 to -5241	Exsudatinite zone
		-5117 to -6153	brown or reddish brown clay 90%, coaly shale 10%.	-5241 to -6153	Vitroliptinite zone
	3	-6153 to -7981	brown or reddish brown clay 90-95%, coaly shale 5-10%.	-6153 to -7553	Vitroliptinite zone
				-7553 to -7946	Vitrinite zone
				-7946 to -7981	Vitroliptinite zone
	2	-7981 to -9012	brown or reddish brown clay 95%, coaly shale 5%.	-7981 to -8321	Vitroliptinite zone
				-8321 to -8442	Vitrinite zone
		-9012 to -9124	brown or reddish brown clay	-8442 to -8561	Vitroliptinite zone
		-9124 to -9354	brown or reddish brown clay 95%, coaly shale 5%.	-8561 to -9354	Vitrinite zone
		-9354 to -9471	brown or reddish brown clay	-9354 to >-9471	Exsudatinite zone
West Graben E	5	-3040 to -4062	gray clay 85-90%, coal or coaly shale 10-15%.	-3040 to -4062	Liptinite zone
	4	-4062 to -4377	gray clay 90-95%, coal or coaly shale 5-10%.	-4062 to -4376	Liptinite zone
		-4377 to -4786	gray/brown or reddish brown clay 100%.	-4376 to -6810	Exsudatinite zone
		-4786 to -6810	brown or reddish brown clay		
	3	-6810 to -6853	brown or reddish brown clay 80%, sand 20%.	-6810 to -8300	Exsudatinite zone
		-6853 to -8200	brown or reddish brown clay		
	2	-8300 to -9086	brown or reddish brown clay	-8300 to >-9959	Exsudatinite zone
		-9086 to -9285	brown or reddish brown clay 40-80%, sand 20-60%.		
		-9285 to >-9959	brown or reddish brown clay		
F	5	-2691 to -4100	gray clay 80-90%, coal or coaly shale 10-20%.	-2691 to -4100	Liptinite zone

Well Name	sequence	Lithology from cutting sample		Macerals distribution	
		depth (ft)	lithology	depth (ft)	maceral zone
	4	-4100 to -4269	gray clay 80-90%, coal or coaly shale 10-20%.	-4100 to -4388	Liptinite zone
		-4269 to -4763	gray/brown or reddish brown clay 100%.	-4388 to -5910	Exsudatinite zone
		-4763 to -6156	brown or reddish brown clay	-5910 to -6151	Liptinite (alginite) zone
	3	-6151 to -6298	brown or reddish brown clay 40-80%, sand 20-60%.	-6151 to -6424	Liptinite (alginite) zone
		-6298 to -6794	brown or reddish brown clay	-6424 to -6794	Exsudatinite zone
		-6794 to -7531	brown or reddish brown clay 95%, coaly shale 5%.	-6794 to -7531	Vitroliptinite zone
		-7531 to -8238	brown or reddish brown clay	-7531 to -8238	Exsudatinite zone
	2	-8238 to >-8770	brown or reddish brown clay	-8238 to >-8770	Exsudatinite zone
G	5	-2890 to -3267	gray clay 85%, coal or coaly shale 15%.	-2890 to -3267	Liptinite zone
	4	-3267 to -3753	gray clay 85-90%, coal or coaly shale 10-15%.	-3267 to -3871	Liptinite zone
		-3753 to -4101	gray/brown or reddish brown clay 100%.	-3871 to -4991	Exsudatinite zone
		-4101 to -4991	brown or reddish brown clay		
	3	-4991 to -5086	brown or reddish brown clay	-4991 to -5196	Exsudatinite zone
		-5086 to -6007	brown or reddish brown clay 95%, coaly shale 5%.	-5196 to -6120	Vitroliptinite zone
		-6007 to -6120	brown or reddish brown clay	-6120 to -6233	Exsudatinite zone
		-6120 to -6453	brown or reddish brown clay 95%, coaly shale 5%.	-6233 to -6550	Vitroliptinite zone
		-6453 to -6550	brown or reddish brown clay		
	2	-6550 to >-7936	brown or reddish brown clay	-6550 to -6669	Vitroliptinite zone
				-6669 to -6776	Exsudatinite zone
				-6776 to -6884	Vitrinite zone
				-6884 to>-7936	Exsudatinite zone
H	5	-3086 to -3169	gray clay 65%, coal or coaly shale 15%, sand 20%.	-3086 to -4006	Liptinite zone
		-3169 to -3344	gray clay 85%, coal or coaly shale 15%.		
		-3344 to -3856	gray clay 65%, coal or coaly shale 15%, sand 20%.		
		-3856 to -4006	gray clay 90%, coal or coaly shale 10%.		
	4	-4006 to -4514	gray clay 90-95%, coal or coaly shale 5-10%.	-4006 to -4654	Liptinite zone
		-4541 to -5351	gray/brown or reddish brown clay 100%.	-4654 to -4765	Exsudatinite zone
				-4765 to -4877	Vitrinite zone
		-5351 to -6118	brown or reddish brown clay	-4877 to -6695	Exsudatinite zone
		-6118 to -6372	brown or reddish brown clay		

Well Name	sequence	Lithology from cutting sample		Macerals distribution	
		depth (ft)	lithology	depth (ft)	maceral zone
			80%, sand 20%.		
		-6372 to -6500	brown or reddish brown clay		
		-6500 to -6627	brown or reddish brown clay		
			60%, sand 40%.		
		-6627 to -6695	brown or reddish brown clay		
	3	-6695 to -7398	brown or reddish brown clay	-6695 to -7398	Exsudatinite zone
		-7398 to -9159	brown or reddish brown clay	-7398 to -7530	Vitroliptinite zone
			95%, coal or coaly shale 5%.	-7530 to -7661	Exsudatinite zone
				-7661 to -8747	Vitroliptinite zone
				-8747 to -9061	Liptinite (alginite) zone
	2	-9061 to >-9159	brown or reddish brown clay	-9061 to ->9159	Liptinite (alginite) zone
			95%, coal or coaly shale 5%.		
I	5	-2919 to -3425	gray clay 85%. coal or coaly	-2919 to -3425	Liptinite zone
			shale 15%.		
	4	-3425 to -3542	gray clay 85-90%, coaly shale	-3425 to -4009	Liptinite zone
			10-15%.		
		-3542 to -3738	gray clay 50-70%, coaly shale		
			10%, sand 20-40%.		
		-3738 to -3830	gray/brown or reddish brown		
			clay 100%.		
		-3830 to -3921	gray/brown or reddish brown		
			clay 95%, coaly shale 5%.	-4009 to -4189	Exsudatinite zone
		-3921 to -4189	gray/brown or reddish brown	-4189 to -4283	Vitroliptinite zone
			clay 100%.	-4283 to -4379	Exsudatinite zone
		4189 to -4579	brown or reddish brown clay	-4379 to -4478	Vitroliptinite zone
		-4579 to -4683	brown or reddish brown clay	-4478 to -4579	Exsudatinite zone
			75%, coal or coaly shale 5%.	-4579 to -4683	Vitroliptinite zone
			sand 20%.	-4683 to -4996	Exsudatinite zone
		-4683 to -5128	brown or reddish brown clay	-4996 to -5101	Vitroliptinite zone
			40-60%, sand 20-60%.	-5107 to -5128	Exsudatinite zone
	3	-5128 to -5207	brown or reddish brown clay	-5128 to -5207	Exsudatinite zone
			40%, sand 60%.		
		-5207 to -6470	brown or reddish brown clay	-5207 to -6470	Vitroliptinite zone
			95%, coal or coaly shale 5%.		
	2	-6470 to -6618	brown or reddish brown clay	-6470 to -8128	Vitroliptinite zone
			95%, coal or coaly shale 5%.		
		-6618 to -6728	brown or reddish brown clay		
			75%, coal or coaly shale 5%.		
			sand 20%.		
		-6728 to -7057	brown or reddish brown clay		
			95%, coal or coaly shale 5%.		
		-7057 to -7166	brown or reddish brown clay		
			75%, coal or coaly shale 5%.		
			sand 20%.		

Well Name	sequence	Lithology from cutting sample		Macerals distribution	
		depth (ft)	lithology	depth (ft)	maceral zone
		-7166 to -7591	brown or reddish brown clay 95%, coal or coaly shale 5%.		
		-7591 to -7695	brown or reddish brown clay 75%, coal or coaly shale 5%, sand 20%.		
		-7695 to -7800	brown or reddish brown clay 95%, coal or coaly shale 5%.		
		-7800 to -8128	brown or reddish brown clay 55-80%, coal or coaly shale 5%, sand 20-40%.		
		-8128 to -8237	brown or reddish brown clay	-8128 to -9112	Exsudatinite zone
		-8237 to -8351	brown or reddish brown clay 40%, sand 60%.		
		-8351 to -8597	brown or reddish brown clay		
		-8597 to -8981	brown or reddish brown clay 80%, sand 20%.		
		-8981 to -9112	brown or reddish brown clay		
		-9112 to 9379	brown or reddish brown clay 40-80%, sand 20-60%.	-9112 to ->9379	Vitroliptinite zone
		>-9379	brown or reddish brown clay		
J	5	-1040 to -1190	gray clay 95%, coal or coaly shale 5%.	-1040 to -1190	Liptinite zone
		-1190 to -1773	gray clay 100%	-1190 to -1339	Exsudatinite zone
		-1773 to -2307	gray clay 95%, coal or coaly shale 5%.	-1339 to -1487	Liptinite zone
				-1487 to -1773	Exsudatinite zone
		-2307 to -2440	gray clay 100%	-1773 to -2307	Liptinite zone
		-2440 to -4098	gray clay 90%, coal or coaly shale 10%.	-2307 to -2440	Exsudatinite zone
				-2440 to -4098	Liptinite zone
	4	-4098 to -4316	gray clay 90%, coal or coaly shale 10%.	-4098 to -4583	Liptinite zone
		-4316 to -4583	gray/brown or reddish brown clay 95%, coaly shale 5%.		
		-4583 to -6453	brown or reddish brown clay	-4583 to -6453	Exsudatinite zone
		-6453 to -7003	brown or reddish brown clay 95%, coaly shale 5%.	-6453 to -6590	Vitroliptinite zone
				-6590 to -6727	Vitrinite zone
				-6727 to -7000	Vitroliptinite zone
				-7000 to -7003	Vitrinite zone
	3	-7003 to -7683	brown or reddish brown clay 95%, coaly shale 5%.	-7003 to -7683	Vitrinite zone
		-7683 to -8383	brown or reddish brown clay	-7683 to -8383	Exsudatinite zone
		-8383 to -8671	brown or reddish brown clay 95%, coaly shale 5%.	-8383 to -8527	Vitroliptinite zone
				-8527 to -8671	Vitrinite zone
		-8671 to -9150	brown or reddish brown clay	-8671 to -9150	Exsudatinite zone
	2	-9150 to >-9547	brown or reddish brown clay	-9150 to >-9547	Exsudatinite zone