5.2 Practice of technology transfer

5.2.1 Planed technology transfer

The initial stage of the Study was mainly field survey, and there was not so much difference between DMR's method and the JICA Study Team's one in exploration by means of outcrop survey, drilling borehole and seismic survey. However the Study Team realized the necessity to improve DMR's method. Then the Study Team practiced technology transfer from the beginning in the course of the Study by means of a series of on the job training and seminar. And the Study Team practiced technology transfer in more detail including basic geological survey and analysis in addition to the above mentioned plan. Technology transfer for the counterpart executed with seminar and training at the initial stage were as follows:

(P:Phrae, N:Nong Plab, M:Mae Lamao, D:DMR's office, J:Japan)

- Outcrop survey and geological mapping — PNJ
- Description of lithofacies applicable for data base — PNMDJ
- Visual logging of the borehole cores — PNM
- Drafting the borehole logs and correlation — PNMDJ
- Analysis of geologic structures — DJ
- Interpretation of the geophysical logs — DJ
- Interpretation of the seismic profiles — DJ
- Sampling of the coal beds — PNMD
- Coal geology — DJ

  Origin of coal and coalification

  Depositional environment of the coal bed

  Tectonics of the coal basin

  Sedimentary structures of the coal beds

  Basin analysis technology
- Geological data base — D

Programming of data base

Operation of data base

- Coal quality analysis D

  Information for coal quality evaluation standard

  Operation of coal quality analysis equipment

- Underground coal mining DJ

  Mining methods
  Mining facilities
  Mine safety, counter measures for risk
  Mining plan
  Beneficiation of coal

- Estimation of quality of the coal product D

5.2.2 Comprehensive analysis and application of the obtained geologic data

As planed, it was recognized important to transfer technology regarding to comprehensive analysis and application of the obtained geologic data. After the initial stage of the Study which mainly consisted of field work, the Study Team practiced intensive technology transfer regarding to analyze the obtained geological data. The Study Team explained and demonstrated the procedure of geological analysis and estimation of the resources, reserves and mineable coal reserves. They are as follows:

- Adjustment of the visual log of the borehole to the geophysical logs (New technology)

  The recovered borehole cores were kept in the core boxes indicating the depth of each run. However there is the difference in depth between the recovered cores and geophysical logs. Therefore the depth of the coal beds of a visual log must be adjusted to the interpreted depth of the coal beds of geophysical logs.

- Adjustment of the data of coal bed (New technology)

  The results of visual logging, geophysical logging, analysis are uniformed to the coal profiles in order to avoid inconsistency between each other.

- Drafting of borehole logs of various scale (Improvement)

  Adjusted borehole logs are drafted with various scale for the purpose of further geological analysis. Lithologic log of scale 1:500 is drafted for detailed correlation. Lithofacies log of scale 1:1,000 ~ 2,000 is drafted for correlation of depositional facies aiming basin analysis.

  Log of scale usually 1:2,000 ~ 5,000, depending on the vertical scale of the geological profile, is drafted for the analysis of geologic structure.

- Correlation of the seismic reflectors and borehole logs (New technology)

  The marker beds in a borehole log are projected on the closest seismic profiles converting the depth to the travel time applying the time/depth table of the closest observation point. Recognizing the relationship between the remarkable reflectors in the seismic profile and the marker beds in a borehole, this relationship is examined to the neighboring boreholes chasing the reflector. And adequacy of correlation is examined.

- Drafting of the geological profiles (New technology)

  Geological profiles are drafted along the lines which pass through the boreholes and seismic survey lines. The borehole logs and outcrop data are projected. Then the coal beds and boundary of the lithofacies boundaries are connected reflecting the seismic profiles. The geologic structures investigated on the seismic profiles are also projected on these profiles converting travel time to depth.

- Drafting of the coal bed section (Improvement)

  The section of a coal bed of scale 1:50 ~ 200 are drafted after adjusting to the analysis results and geophysical logs. These sections are drafted arranging to the appropriate directions correlating the coal plies and partings. This correlation indicates the morphological change of the coal beds from place to place in addition to change in quality. Then the geological reasons of such changes are investigated with basin analysis technology.

- Drafting of the coal bed maps (Improvement)

  The coal bed maps are drafted for each coal beds of more than 0.5m in thickness with the following procedures:

  The borehole locations, geological profile lines, topographic grid lines are drafted. The contour lines of depth with an appropriate interval (Seam contour map) are drafted connecting the intersection of the coal bed and depth line on the geological profiles. The thickness of each coal bed is shown as a contour map (Isopach) with an appropriate interval of thickness analyzing the change in thickness on the coal bed section. If it is necessary to investigate the change of parting in thickness to decide the mineable area, the isopach for the parting is also drafted. The outcrop line, intersection of the depth contour lines to the determined geologic structures on the geological profiles are plotted, too.

- The resources, reserves are estimated on these coal bed maps delineating the geologic assurance areas. (Improvement)

  The standard for estimation adopted by the Study Team is explained in the previous chapter of this report (3.1.3.(5)).

- These coal bed maps are utilized for mining plan (New technology)

- The mineable coal reserves are estimated on the mining plan. (New technology)

- The feasibility of a mine development is evaluated comparing the investment and cost estimated by mining plan to the price of the produced coal. (New technology)

5.3 Results

5.3.1 Immediate results

(1) Effective coal analysis

Coal analysis equipment supplied by JICA were installed in DMR's laboratory and fully utilized. Their capacity of analysis increased ten times efficient compared to the previous ones, and the problem of inefficient analysis was solved. This improvement makes prompt analysis. It improves avoiding change in conditions of samples for various kinds of analysis, especially in moisture contents .

(2) Presentation of the results of the Study in the International Conference

During the Study, the Study Team summarized the stratigraphy of the Phrae Basin. The "Phrae Formation" is proposed to denominate the Tertiary formation owing to the difference in lithofacies from the Mae Moh Basin, which represents the standard stratigraphy of the Tertiary intermontane basins in the northern Thailand. DMR organized the International Conference on Stratigraphy and Tectonic Evolution of Southeast Asia and the South Pacific. The main cooperative organizations of the conference are Geological Society of Thailand, Mining Industry Council, Thai Mining Engineer Association, Chulalongkorn University, Chiang Mai University, Prince of Songkhla University. DMR, the counterpart of the Study, requested JICA to present the results of investigation of Phrae Formation to the conference. JICA agreed it and dispatch Mr. Jiro Muraoka, the leader of the Study Team, to the conference, and he made a presentation of the results of geological assessment of the Phrae Basin on August 20, 1997. It means that a part of technical transfer was executed not only for DMR personnel but also for the society of Thai geologists. The paper, "The Tertiary deposits-Phrae Formation-in the Phrae Basin", is attached in Appendix 4.

(3) Three scholarship master course students to foreign universities

Mr. Phumi Srisuwan, Mr. Kriangkrai Phontin and Miss Aree Rittipat, are members of the counterpart study team. They accomplished the Study with the Study Team and are transferred significantly important technology and absorbed invaluable experience and know-how from Japanese experts.

The two persons of them, Mr. Kriangkrai Phomin and Miss Aree Rittipat, are participants of the counterpart training of JICA during the Study period in Japan. They executed cooperative study on geological interpretation of coal exploration data and high resolution seismic survey interpretation. The details of the technology are mentioned above. In addition, they visited coal mines and coal utilization facilities or plants which are coking plant, blast furnace, coal liquefaction plant etc. in Japan.

The cooperative study and experience during the Study induced them to study advanced coal geology and relating science and engineering. They challenged the examination of scholarship for the student study abroad and passed it. Mr. Phumi Srisuwan was accepted his applications for basin analysis by the London University, Mr. Kriangkrai Phomin by the South Dakota University and Miss Aree Rittipat by the Pennsylvania State University. They left Thailand for the U.K. and the U.S. and started their study in the master course of each university.

5.3.2 Results of technology transfer

As mentioned above, technology transfer in the Study was completed. The estimation of the results of technology transfer is very difficult, however JICA and DMR study teams attempt to it and is shown in Table 5.3-1.

Table 5.3-1 The Comparison of transferred technology between before and after the Study

Transferred Technology	Before the Study in DMR	After the Study in DMR (Evaluation of transfer)
I. Exploration technology		
1) Outcrop survey and route mapping	Need Improvement	All geologists of DMR study team apply the technology to their job.
2) Description of lithology with lithofacies cod system	Non	All geologists of DMR study team aquired and some of them aplly it to their job
3) Criteria for exploration works such as sampling	Need Improvement	All geologists of DMR study team apply the technology to their job
4) Interpretation of logging and seismic survey data	(Need Improvement)	
· Manual interpretation of geophysical logs depending on basic theory	Non	About half of geologists of DMR study team can apply the technology to their job
· Adjustment of the visual log of the borehole to the geophysical logs	Non	All geologists of DMR study team apply the technology to their job
· Adjustment of the data of coal bed to the analysis results.	Non	About half of geologists of DMR study team can apply the technology to their job
· Drafting of borehole logs of various scale	Need Improvement	All geologists of DMR study team apply the technology to their job
· Correlation of the seismic reflectors and borehole logs	Non	About half of geologists of DMR study team can apply the technology to their job
· Drafting of the geological profiles	Non	About half of geologists of DMR study team can apply the technology to their job
5) Estimation resources, etc. and quality of the product	(Need Improvement)	
· Estimation of resources, reserves on these coal bed maps	Non	About half of geologists of DMR study team can apply the technology to their job
· Estimation of mineable coal reserves on the mining plan.	Non	About half of geologists of DMR study team can apply the technology to their job
· Estimation of quality of the coal product	Non	About half of geologists of DMR study team can apply the technology to their job
6) Basin analysis technology	(Non)	
· Drafting of the coal bed section	Non	About half of geologists of DMR study team can apply the technology to their job
· Drafting of the coal bed maps	Non	About half of geologists of DMR study team can apply the technology to their job
II Technology for geological database		
1) Programming of data base	Non	A few specialist of DMR can apply the technology for their job
2) Operation of data base	Non	Members of DMR study team can use the technology by themselves
III Technology for coal quality analysis		
1) Information for coal quality evaluation standard	Need Improvement	Members of DMR study team can use the technology by themselves
2) Operation of coal quality analysis equipment	Non	A few specialist can operate equipment, however results of analysis are utilized in DMR
IV Technology for underground coal mine development		
1) Mining methods	Non	A few specialist of DMR can apply the technology for their job
2) Mining facilities	Non	A few specialist of DMR can apply the technology for their job
3) Mine safety, counter measures for risk	Non	A few specialist of DMR can apply the technology for their job
4) Mining plan	Non	A few specialist of DMR can apply the technology for their job

5.4 Practice of transferred technology in DMR

Owing to considerable difference between the conventional exploration method and transferred technology in addition to only a few existing experienced geologists, DMR may be not possible to practice exploration totally with transferred technology right now. But DMR's ongoing plan to expand its function to development enforces to practice exploration with transferred technology. Because, the conventional technology is not enough, and the transferred technology is needed for the development of the resources. Actually DMR is going to adopt lithofacies coding method transferred by the Study Team for the convenience and effectiveness. And they intends to adopt transferred technology as follows:

for exploration technology,

- Partial adoption what DMR can practice such as lithofacies coding method;
- Standardization of the exploration work including sampling;
- Practice of correlation;
- Formation of one team that conducts exploration with transferred technology referring this report;
- Assignment of an experienced geologist who practice transferred technology;
- Gradual increase of the exploration team that conducts exploration with transferred technology,

for other technology,

- Assignment of experienced specialists who have transferred technology to teach other specialists.

5.5 Conclusion and recommendation

5.5.1. Conclusion

(1) Completed planed technology transfer

It is not exaggeration to say that the undertaking of technology transfer on the Study was carried out as planed and we obtained satisfactory results. From a series of on the job training, seminar and especially counterpart training in Japan, participants of the training have had a lot of instructive and interesting experience. DMR has systematic and effective technology of exploration, evaluation, geological database, coal quality analysis for coal development, now.

(2) Effective exploration results for development

Through the Study, the Study Team transferred how to utilize and analyze the obtained geological data comprehensively. However DMR was not familiar with the development especially planning of it. According to DMR's expansion plan, DMR will be in charge of the development in the near future. For this expansion plan, it is very necessary to learn how to utilize and analyze the obtained data by themselves. Otherwise they can not obtain the effective geological data. The counterpart members understood the transferred technology of exploration and underground mining through the joint work with the Study Team. However, exploration needs long period of two or three years with continuous devotion for the work. And also the inexperienced geologic phenomena which have not been experienced throughout the Study will occur in general. Therefore it necessitates the further study, which comprise from exploration to feasibility study. In which exploration shall be conducted by the DMR's member under the assistance of the experienced mining geologists, and the feasibility study shall be conducted cooperatively with the experts and DMR's members. Hence the members of DMR will be able to learn and experience by themselves what is the necessary geological data for development.

5.5.2. Recommendation

DMR believes it is essential to improve it's previous technology to the technology transferred from the Study Team of JICA. Also DMR believes it is very necessary to learn and acquire the capability of assessment of the resources development plans or project. In order to meet these needs, it is recommended to execute a feasibility study on an appropriate coal basin requesting JICA a new international cooperative study.

APPENDICES

Appendix 1. Coal Quality

Appendix II Coal Quality

At DMR coal analysis is carried out based on ASTM. In many cases analytical items are proximate analysis, heating value (calorific value), total sulfur and specific gravity. Some parameters of them are converted to other basis in order to classify coals in accordance with ASTM D388. Table 1 shows the form of the analysis report.

Table 1 Form of Analysis Report

Basis	As Determined							DMMF		Moist, MMF	Class/ Group
Sample No.	Moisture (%)	Ash (%)	Volatile Matter (%)	Fixed Carbon (%)	Heating Value (cal/g)	Sulfur (%)	Specific Gravity	Fixed Carbon (%)	Volatile Matter (%)	Heating Value (Btu/lb)	

DMMF : Dry, Mineral-Matter-Free Basis

Moist, MMF : Moist, Mineral-Matter-Free basis

Number of samples analyzed at DMR for each basin is shown in Table 2. Analytical results are attached at the end of this Appendix with some additional figures which are converted from determined basis and necessary to evaluate the results. Unfortunately major part of these samples taken from Nong Plab and Mae Lamao basin may not show representative quality of each coal bed because of inadequate sampling method. Also for Phrae basin enough data has not obtained yet. So only general trend of some quality parameters and relationship between them are described in Section 1.

Table 2 Number of Analysis Sample

Basin	number of boreholes	number of samples
Phrae	9	26
Nong Plab	37	54
Mae Lamao	34	379

1. General trend of each quality parameters

1.1 Rank of coal

In the ASTM coal classification system, coals having 69% or more fixed carbon on the dry, mineral-matter-free basis are classified according to fixed carbon, regardless of gross calorific value on the moist, mineral-matter-free basis as shown in Table 3. If the coal is to be ranked on a moist basis using a drill core sample, inherent moisture should be determined by sample equilibrated at 30℃ and 97% humidity (D388 7.1.4 and 7.2.3).

Table 3 ASTM Coal Classification (ASTM D388)

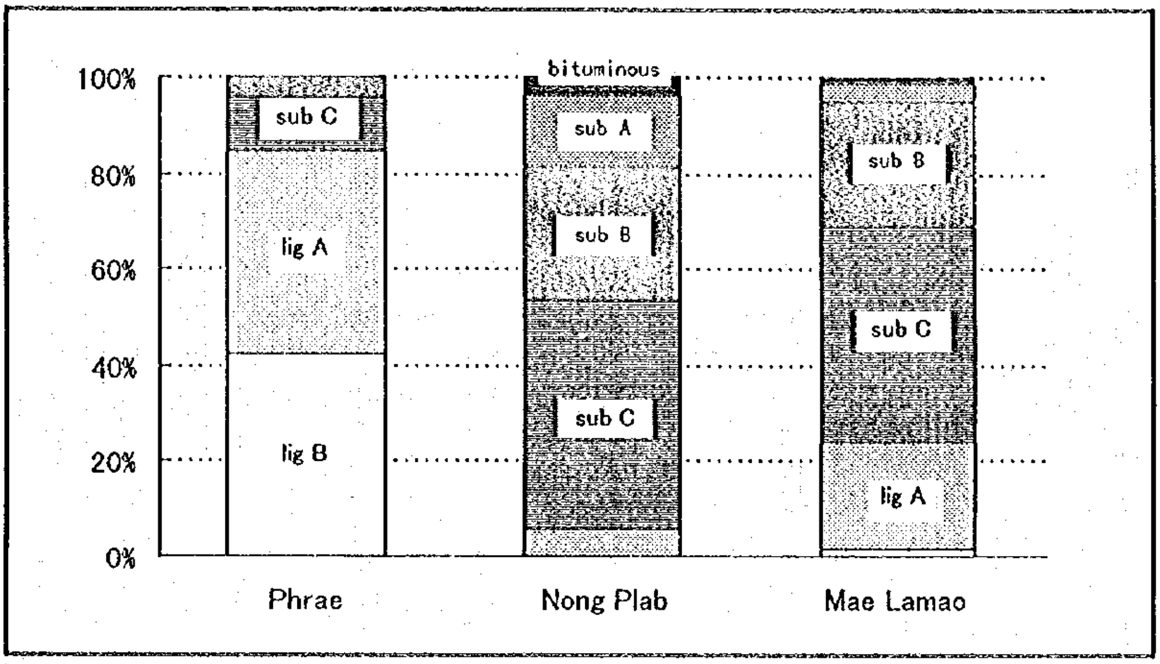
Class / Group	Fixed Carbon	Volatile Matter	Gross Calorific Value		Agglomerating Character
	DMMF		Moist, MMF		
	%		Btu/lb	MJ/kg	
Anthracite :					
Meta-anthracite	98≦	≦ 2	----	----	nonagglomerating
Anthracite	92≦ <98	2< ≦ 8	----	----	
Semianthracite	86≦ <92	8< ≦14	----	----	
Bituminous :					
Low volatile	78≦ <86	14< ≦22	----	----	commonly agglomerating
Medium volatile	69≦ <78	22< ≦31	----	----	
High volatile A	<69	31<	14000≦	32.6≦	
High volatile B	----	----	13000≦ <14000	30.2≦ <32.6	
High volatile C	----	----	11500≦ <13000	26.7≦ <30.2	
	----	----	10500≦ <11500	24.4≦ <26.7	agglomerating
Subbituminous :					
Subbituminous A	----	----	10500≦ <11500	24.4≦ <26.7	nonagglomerating
Subbituminous B	----	----	9500≦ <10500	22.1≦ <24.4	
Subbituminous C	----	----	8300≦ < 9500	19.3≦ <22.1	
Lignitic :					
Lignite A	----	----	6300≦ <8300	14.7≦ <19.3	
Lignite B	----	----	<6300	<14.7	

If low rank coals are allowed to dry they cannot be rewetted to the moisture they held before drying. So equilibrium moisture status should be approached from "wet" side for low rank coals.

Though moisture content of air dried samples are used for calculation of heating value on the moist, mineral-matter-free basis at DMR, it is recommended to determine above mentioned equilibrium moisture in addition to air dried moisture for more accurate classification.

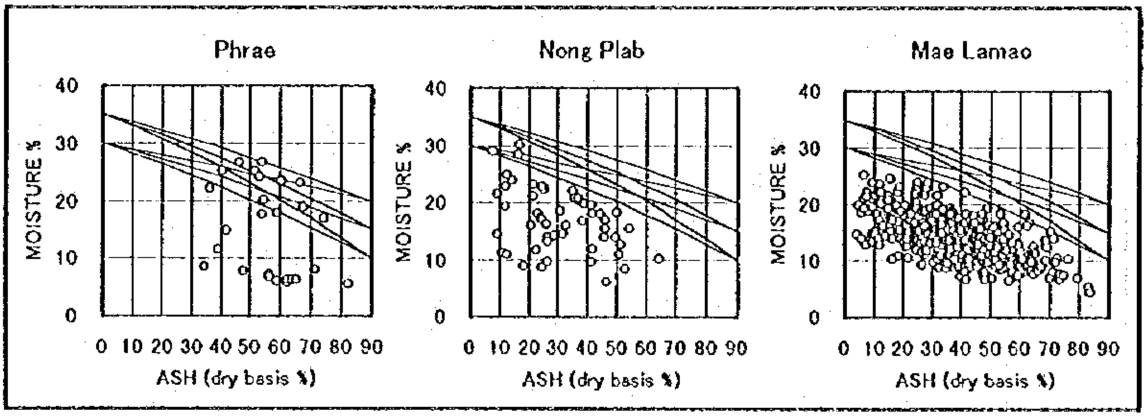
Coals from Phrae, Nong Plab and Mae Lamao basin have less than 69% fixed carbon on the dry, mineral-matter-free basis and are classified according to calorific value. Figure 1 shows coal rank that is determined from heating value on the moist, mineral-matter-free basis calculated from moisture of air dried sample.

Figure 1 Coal Rank of Each Basin (based on air-dried moisture)



Coal rank varies a wide range even in a basin maybe because of significantly variable moisture content. Moisture content on the determined basis varies in a wide range as shown in Figure 2.

Figure 2 The Relationship between Ash and Moisture



Low rank coals such as subbituminous or lignitic class will always contain at least 30% on the moist, mineral-matter free basis and mineral matter will contain less moisture than such coals. In case that coal with some ash is regarded as the mixture of pure coal and pure mineral matter, moisture content is calculated by next formula.

$$M = 100 - Am(100 - M1)(100 - M2)/\{Am(100 - M2) + A(M2 - M1)\}$$

M : moisture content of mixture

Am : ash content of mineral matter on the dry basis

M1 : moisture content of pure coal

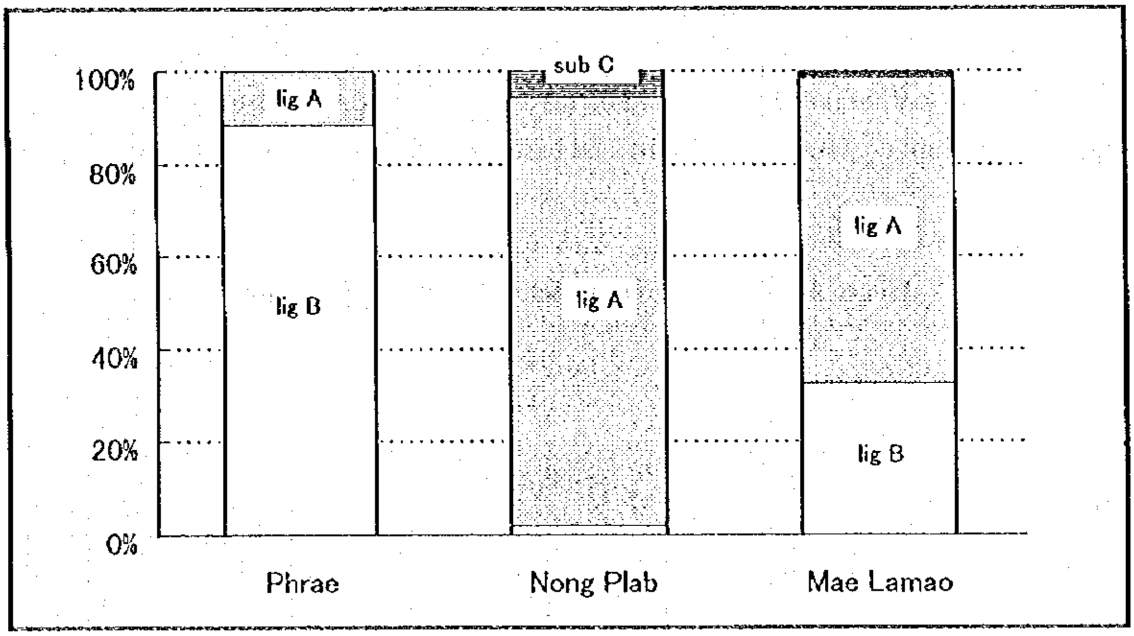
M2 : moisture content of pure mineral matter

A : ash content of mixture on the dry basis

The lines in Figure 2 show the relationships between moisture and ash of mixture for several cases.

Figure 3 shows coal rank estimated on the assumption that moisture content on the moist basis are 30% for pure coal and 20% for pure mineral matter respectively.

Figure 3 Coal rank of each basin based on the assumed moist basis



It seems that coals from these basin are mostly classified into lignitic and coals from Nong Plab basin is highest rank within them.

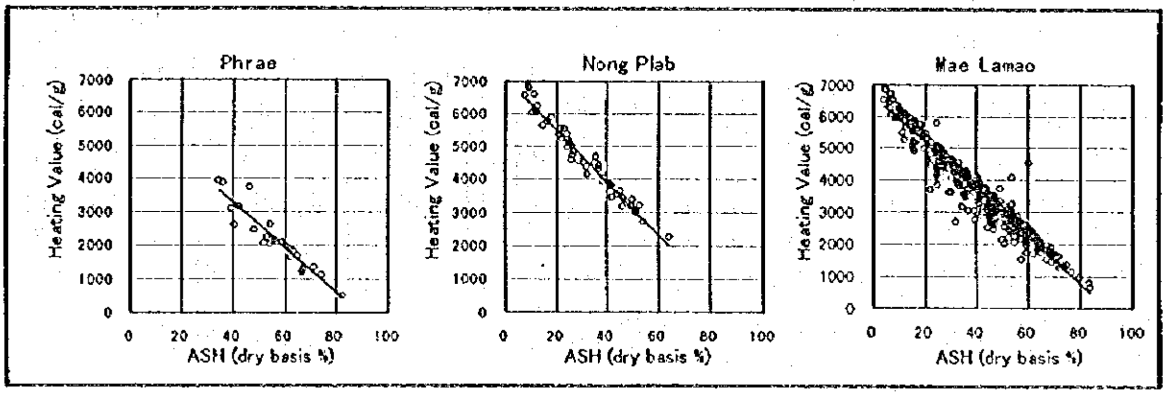
1.2. Ash and heating value

The relationship between ash and heating value is examined for each basin. Good correlation is recognized between them on the dry basis as shown in Table 4 and Figure 4.

Table 4 Relationship between Ash and Heating Value

Model	Heating Value = a + b × Ash Heating Value : dry basis [cal/g] Ash : dry basis [%]			
Basin	a	b	correlation coefficient	Ash at CV=0
Phrae	5942	−66.35	0.9374	88.89
Nong Plab	7113	−79.37	0.9831	89.60
Mae Lamao	6639	−73.33	0.9647	90.57

Figure 4 Relationship between Ash and Heating Value

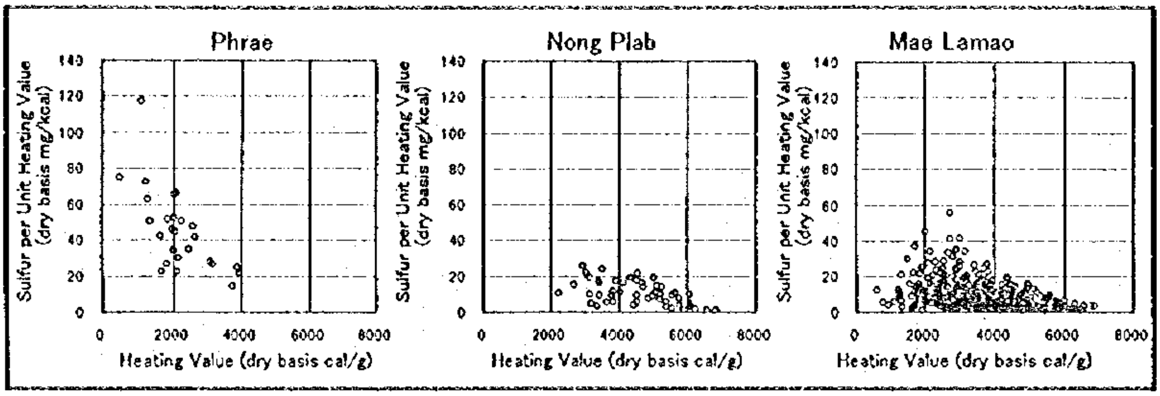


Perhaps heating value is the most important quality parameter as fuel. Coal from Phrae basin seems to be lower heating value at same ash level than other basins. Also the distribution of ash content for Phrae basin is in higher range than others.

1.3 Sulfur content

Sulfur content is one of the most important parameter on environmental viewpoint. It is recommended to evaluate not only sulfur content itself but also sulfur content per unit heating value. Figure 5 shows the relationship between heating value and sulfur content per unit heating value on the dry basis.

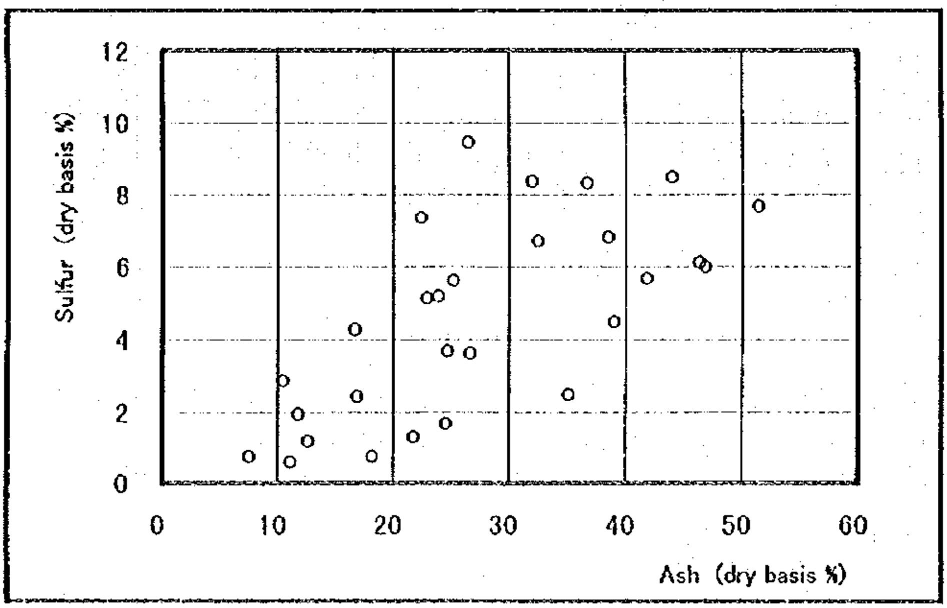
Figure 5 Relationship between Heating Value and Sulfur content per Unit Heating Value



There are not so good correlation in these parameters but the trend is recognized that sulfur content per unit heating value is highest and heating value is lowest in Phrae among these basin.

Generally there is no correlation between ash content and sulfur content. But except some samples collected from near the parting or parting itself, rough correlation is recognized for Nong Plab basin as shown in Figure 6. This reason is attributed to degradation of original peat.

Figure 6 Relationship between Ash and Sulfur in Nong Plab Basin



1.4 Relationship between ash and specific gravity

Sometimes it is necessary to estimate specific gravity from ash content. The relationship between ash and specific gravity on the dry basis is examined for each basin and shown in Table 5 and Figure 7. Model 2 or 3 is more appropriate than Model 1 on the viewpoint of correlation coefficient and estimated specific gravity of pure materials.

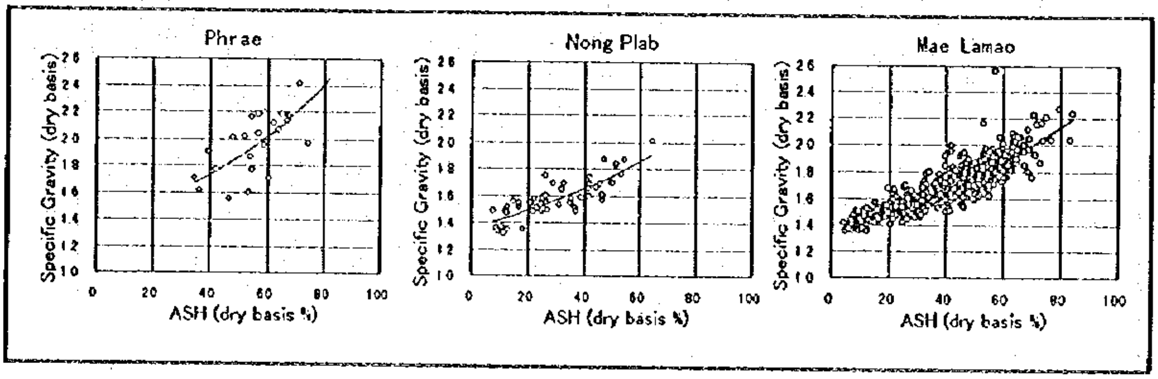
Table 5 Relationship between Ash and Specific Gravity

Model 1: Specific Gravity = a + b × Ash
Model 2: Specific Gravity = c ÷ (d − Ash)
Model 3: Specific Gravity = $10^{(e+f\times Ash)}$

Specific Gravity : dry basis [-]
Ash : dry basis [%]

Basin	a	b	c	d	e	f	Correlation Coefficient	SG of pure coal	SG of pure mineral
Phrae	1.063	0.0165					0.7420	1.063	2.526
Nong Plab	1.327	0.0084					0.8293	1.327	2.082
Mae Lamao	1.315	0.0094					0.8529	1.315	2.156
Phrae			247	183			0.7172	1.353	2.635
Nong Plab			304	224			0.8252	1.358	2.263
Mae Lamao			306	223			0.8762	1.371	2.306
Phrae					0.0969	0.0035	0.7319	1.250	2.568
Nong Plab					0.1286	0.0023	0.8291	1.345	2.151
Mae Lamao					0.1296	0.0024	0.8674	1.348	2.208

Figure 7 Relationship between Ash and Specific Gravity

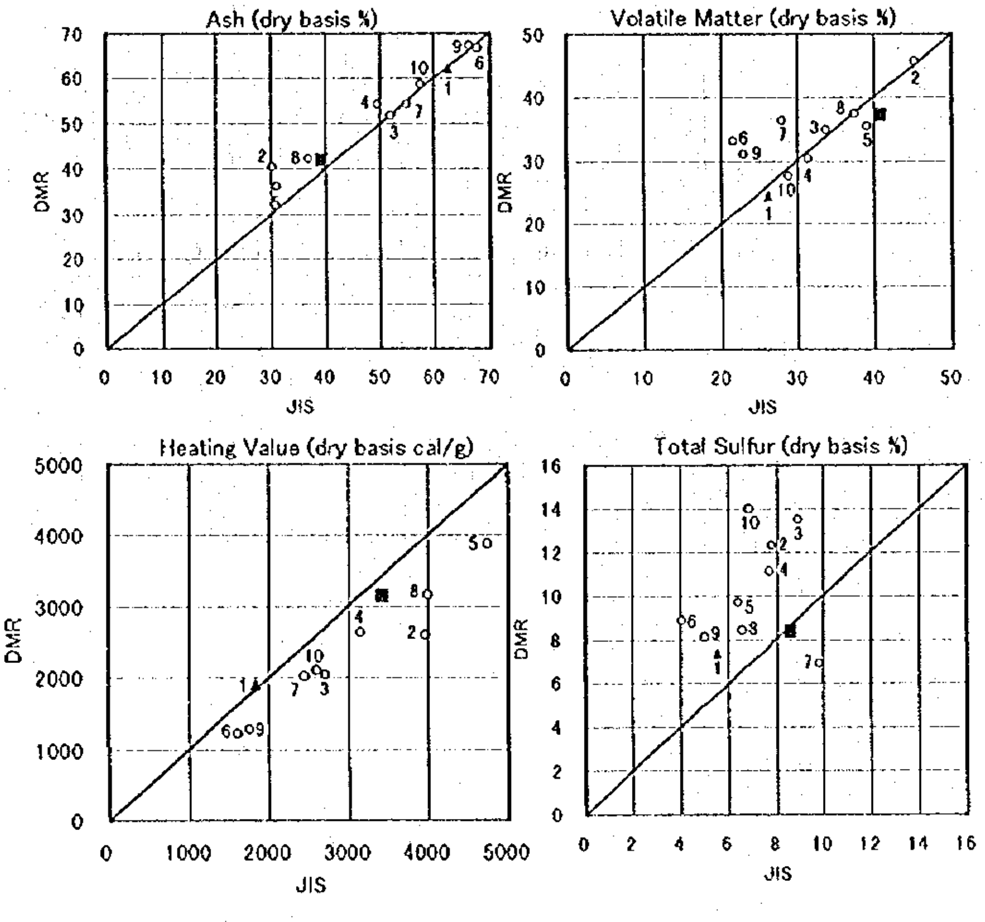


2. Comparison of analytical results DMR and Japan

Ten samples from Phrae basin have been analyzed at Japanese laboratory based on relevant Japanese Industrial Standard (JIS). As moisture content varies by drying condition, analytical results from DMR and Japanese laboratory have been compared on the dry basis as shown in Figure 8.

Figure 8 Comparison of Analytical Results

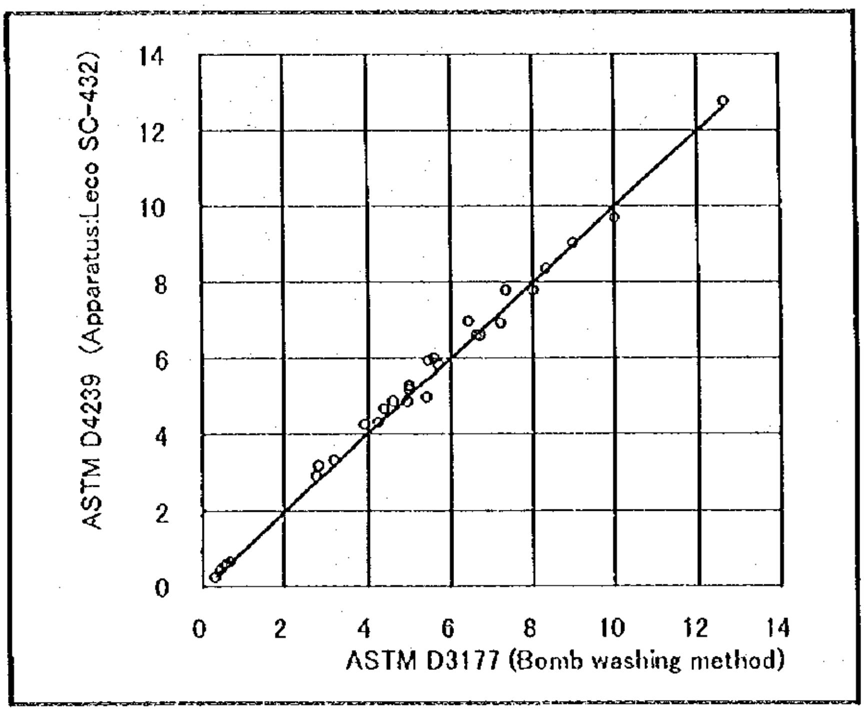
Sample No.	Hole No.	Sample from	to	thickness
1	4 /38	407.20	408.70	1.50
2	2 /39	257.80	258.60	0.80
3	3 /39	298.50	299.30	0.80
4	3 /39	590.80	591.40	0.60
5	3 /39	591.70	592.00	0.30
6	1 /40	130.90	131.35	0.45
7	1 /40	131.70	132.00	0.30
8	1 /40	274.50	275.90	1.40
9	2 /40	301.60	303.20	1.60
10	2 /40	403.70	405.00	1.30



The difference between them seems to be partially caused by unstable air dried moisture content of low rank coals. Even though the sample is in sealed containers, it has experienced that significant variations can occur in the moisture content obtained different days. So it is recommended to re-determine the moisture content each day on which moisture dependent analysis is undertaken. But speedup of analysis as a result of the introduction of instrumental procedures will considerably reduce the necessity of re-determination.

Other possible reason of difference may be sample preparation and division method rather than each of analytical procedures. As samples collected from Phrae basin have been thicker than that from other basin, some segregation may be occurred due to lack of enough experience. If the sample is not thoroughly mixed, especially sulfur tends to segregate due to its high specific gravity because the major part of sulfur exists as the form of pyritic in this basin. The values by DMR for sample No.1 (▲ in Figure 8) calculated from the results for relatively thin 10 samples, and values for same analytical sample (■ in Figure 8) are very close to Japanese results. Also very good correspondence is recognized between sulfur content analyzed by Bomb Washing Method and by Instrumental Method for same analysis sample.

Figure 9 Comparison between Bomb Washing Method and Instrumental Method



The values of volatile matter by DMR for sample No.6, 7 and 9 are considerably higher than that by Japanese laboratory. Appropriate pretreatment is necessary to determine volatile matter for sparking coals such as lignitic. DMR applies such treatment but regarding above samples, some sparking seems to be occurred because these samples shows significantly lower fuel ratio (fixed carbon / volatile matter).

Higher heating value by Japanese laboratory is partially caused that they are not corrected for the heat of formation of sulfuric and nitric acid. Considerable differences of heating value for sample No. 2, 5 and 8 correspond to differences of ash content.

Phrae Basin 1 / 1

hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
PH 1 /38	PHC 001	198.25	199.90	1.65	1.530	20.24	43.49	26.30	9.97	0.38	1715	3.86	1.768	54.5	33.0	2150	4.84	22.51	4728	72.51	5685	ligB
PH 1 /38	PHC 002	334.91	335.52	0.61	1.399	24.16	40.24	29.07	6.53	0.22	1701	8.58	1.603	53.1	38.3	2243	11.31	50.44	4778	81.66	5080	ligB
PH 1 /38	PHC 003	351.10	352.64	1.54	1.464	23.42	46.30	25.48	4.80	0.19	1510	6.97	1.706	60.5	33.3	1972	9.10	46.16	4987	84.15	5133	ligB
PH 1 /38	PHC 004	352.64	352.89	0.25	1.691	16.80	61.75	28.62	−7.17	−0.25	932	10.93	1.965	74.2	34.4	1120	13.14	117.27	4345	133.43	4143	ligB
PH 1 /38	PHC 005	352.89	353.05	0.16	1.354	26.70	33.97	29.29	10.04	0.34	2738	3.94	1.554	46.3	40.0	3735	5.38	14.39	6962	74.47	7738	ligA
PH 4 /38	PHC 006	288.14	288.22	0.08	1.724	11.62	34.67	32.71	21.00	0.64	2733	7.63	1.905	39.2	37.0	3092	8.63	27.92	5088	60.90	7776	ligA
PH 4 /38	PHC 007	409.90	409.95	0.05		6.21	58.42	22.32	13.05	0.58	1549	6.60		62.3	23.8	1652	7.04	42.61	4379	63.10	7387	ligA
PH 4 /38	PHC 008	411.45	411.51	0.06	1.990	5.70	58.61	26.56	9.13	0.34	1753	9.11	2.117	62.2	28.2	1859	9.66	51.97	4912	74.42	8520	subC
PH 4 /38	PHC 009	411.51	411.61	0.10	2.454	5.49	77.65	13.49	3.37	0.25	474	3.55	2.680	82.2	14.3	502	3.76	74.89	2811	80.01	4763	ligB
PH 4 /38	PHC 010	411.61	411.80	0.19	1.608	8.50	31.51	38.11	21.88	0.57	3598	7.73	1.704	34.4	41.7	3932	8.45	21.48	5998	63.53	9867	subB
PH 4 /38	PHC 011	411.80	411.90	0.10	1.938	6.25	59.64	19.64	14.47	0.74	1720	4.62	2.067	63.6	20.9	1835	4.93	26.86	5043	57.58	8669	subC
PH 4 /38	PHC 012	411.90	412.10	0.20	2.054	6.01	55.27	23.57	15.15	0.64	1933	10.06	2.202	58.8	25.1	2057	10.70	52.04	4992	60.87	8559	subC
PH 4 /38	PHC 013	412.10	412.20	0.10	2.024	6.82	52.74	23.87	16.57	0.69	1947	8.71	2.188	56.6	25.6	2090	9.35	44.74	4815	59.03	8024	ligA
PH 4 /38	PHC 014	412.20	412.60	0.40	2.172	8.02	65.62	17.32	9.04	0.52	1235	6.23	2.419	71.3	18.8	1343	6.77	50.45	4685	65.71	7437	ligA
PH 4 /38	PHC 015	412.60	412.70	0.10	1.898	7.22	52.38	25.63	14.77	0.58	2005	6.03	2.041	56.5	27.6	2161	6.50	30.07	4963	63.44	8245	ligA
PH 4 /38	PHC 016	412.70	412.80	0.10	2.034	6.27	60.91	21.98	10.84	0.49	1573	3.60	2.185	65.0	23.5	1678	3.84	22.89	4793	66.97	8225	ligA
PH 4 /38	PHC 017	412.80	412.90	0.10	1.865	7.80	44.14	29.02	19.04	0.66	2287	7.94	2.012	47.9	31.5	2480	8.61	34.72	4759	60.38	7755	ligA
PH 2 /39	PHC 001	257.80	258.60	0.80	1.477	25.18	30.32	34.26	10.24	0.30	1938	9.18	1.759	40.5	45.8	2590	12.27	47.37	4355	76.99	4870	ligB
PH 3 /39	PHC 002	298.50	299.30	0.80	1.607	25.26	38.70	26.02	10.02	0.39	1537	10.10	2.022	51.8	34.8	2056	13.51	65.71	4265	72.20	4296	ligB
PH 3 /39	PHC 003	590.80	591.40	0.60	1.618	17.65	44.50	24.94	12.91	0.52	2175	9.14	1.865	54.0	30.3	2641	11.10	42.02	5746	65.89	7371	ligA
PH 3 /39	PHC 004	591.70	592.00	0.30	1.423	22.18	28.25	27.54	22.03	0.80	3014	7.50	1.618	36.3	35.4	3873	9.64	24.88	6080	55.56	7726	ligA
PH 1 /40	PHC 001	130.90	131.35	0.45	1.690	23.14	51.27	25.44	0.15	0.01	941	6.82	2.133	66.7	33.1	1224	8.87	72.48	3677	99.41	3309	ligB
PH 1 /40	PHC 002	131.70	132.00	0.30	1.650	26.66	39.71	26.70	6.93	0.26	1487	5.08	2.160	54.1	36.4	2028	6.93	34.16	4422	79.39	4460	ligB
PH 1 /40	PHC 003	274.50	275.90	1.40	1.590	14.72	35.94	31.91	17.43	0.55	2696	7.17	1.770	42.1	37.4	3161	8.41	26.59	5464	64.67	7851	ligA
PH 2 /40	PHC 004	301.60	303.20	1.60	1.780	18.81	54.68	25.12	1.39	0.06	1048	6.56	2.173	67.3	30.9	1291	8.08	62.60	3953	94.76	4174	ligB
PH 2 /40	PHC 005	403.70	405.00	1.30	1.670	17.82	48.26	22.62	11.30	0.50	1740	11.50	1.954	58.7	27.5	2117	13.99	66.09	5130	66.69	6153	ligB

Nong Plab Basin 1 / 2

hole	sample	analytical sample			as analysed basis								dry basis						dry ash free basis		ASTM class	
No.	No.	from	to	thick	SpGr	M	ASH	VM	FC	(FR)	CV	TS	SpGr	ASH	VM	CV	TS	TSmg/kcal	CV	VM	Btu/lb	Class
NP	4 /36 NPC 001	372.20	372.25	0.05	1.778	5.98	43.99	25.13	24.90	0.99	3209	5.63	1.871	46.8	26.7	3413	5.99	17.54	6414	50.23	11124	subA
NP	5 /36 NPC 002	106.00	106.05	0.05	1.659	8.46	48.49	25.88	17.17	0.66	2943	1.37	1.767	53.0	28.3	3215	1.50	4.66	6836	60.12	11154	subA
NP	6 /36 NPC 003	116.50	116.55	0.05	1.475	11.52	19.85	32.85	35.78	1.09	4642	6.51	1.572	22.4	37.1	5246	7.36	14.02	6764	47.87	10709	subA
NP	7 /36 NPC 004	121.00	121.05	0.05	1.360	19.22	9.64	33.56	37.58	1.12	4936	1.56	1.487	11.9	41.5	6110	1.93	3.16	6938	47.17	9925	subB
NP	8 /36 NPC 005	100.00	100.05	0.05	1.504	17.97	34.32	28.02	19.69	0.70	3139	3.70	1.691	41.8	34.2	3827	4.51	11.79	6579	58.73	8974	subC
NP	9 /36 NPC 006	114.50	114.55	0.05	1.422	15.83	17.60	33.00	33.57	1.02	4534	1.41	1.545	20.9	39.2	5387	1.68	3.11	6811	49.57	10086	subB
NP	9 /36 NPC 007	121.50	121.55	0.05	1.435	17.14	19.82	29.97	33.07	1.10	4315	4.31	1.577	23.9	36.2	5208	5.20	9.99	6845	47.54	9907	subB
NP	10 /36 NPC 008	61.00	61.05	0.05	1.405	16.84	20.36	32.48	30.32	0.93	4457	1.39	1.531	24.5	39.1	5360	1.67	3.12	7097	51.72	10296	subB
NP	10 /36 NPC 009	69.00	69.05	0.05	1.402	13.13	23.20	33.52	30.15	0.90	4204	3.16	1.493	26.7	38.6	4839	3.64	7.52	6603	52.65	10121	subB
NP	12 /36 NPC 010	151.00	151.05	0.05	1.352	22.32	19.92	28.28	29.48	1.04	3947	5.77	1.504	25.6	36.4	5081	7.43	14.62	6833	48.96	9050	subC
NP	15 /36 NPC 011	41.70	41.75	0.05	1.445	13.84	22.86	33.21	30.09	0.91	4302	8.16	1.556	26.5	38.5	4993	9.47	18.97	6796	52.46	10358	subB
NP	16 /36 NPC 012	79.00	79.05	0.05	1.548	14.02	42.66	23.72	19.60	0.83	2737	2.75	1.700	49.6	27.6	3183	3.20	10.05	6318	54.76	9137	subC
NP	17 /36 NPC 013	42.40	42.45	0.05	1.517	9.69	23.72	33.56	33.03	0.98	4244	5.94	1.606	26.3	37.2	4699	6.58	14.00	6373	50.40	10324	subB
NP	4 /37 NPC 014	51.50	51.55	0.05	1.553	9.74	37.31	28.41	24.54	0.86	3473	2.12	1.652	41.3	31.5	3848	2.35	6.10	6559	53.65	10498	subB
NP	7 /37 NPC 015	84.50	84.55	0.05	1.311	11.19	9.30	35.41	44.10	1.25	5371	2.53	1.364	10.5	39.9	6048	2.85	4.71	6755	44.54	10773	subA
NP	7 /37 NPC 016	160.40	160.45	0.05	1.328	22.79	9.33	31.27	36.61	1.17	4672	1.75	1.470	12.1	40.5	6051	2.27	3.75	6883	46.07	9355	subC
NP	8 /37 NPC 017	151.00	151.05	0.05	1.344	24.71	9.56	29.53	36.20	1.23	4552	4.40	1.515	12.7	39.2	6046	5.84	9.67	6925	44.93	9138	subC
NP	9 /37 NPC 018	88.00	88.05	0.05	1.376	23.75	11.07	33.72	31.46	0.93	4292	4.46	1.559	14.5	44.2	5629	5.85	10.39	6585	51.73	8766	subC
NP	9 /37 NPC 019	158.50	158.55	0.05	1.539	14.13	24.80	28.84	32.23	1.12	3895	6.71	1.689	28.9	33.6	4536	7.81	17.23	6378	47.22	9602	subB
NP	9 /37 NPC 020	178.50	178.55	0.05	1.648	15.56	45.76	22.57	16.11	0.71	2287	3.47	1.871	54.2	26.7	2708	4.11	15.17	5913	58.35	8102	ligA
NP	11 /37 NPC 021	103.00	103.05	0.05	1.506	14.44	27.32	35.78	22.46	0.63	3747	7.16	1.647	31.9	41.8	4379	8.37	19.11	6434	61.44	9596	subB
NP	12 /37 NPC 022	43.50	43.55	0.05	1.381	17.98	18.86	36.85	26.31	0.71	4537	4.21	1.507	23.0	44.9	5532	5.13	9.28	7183	58.34	10290	subB
NP	13 /37 NPC 023	137.00	137.05	0.05	1.367	21.11	17.07	32.63	29.19	0.89	4226	2.56	1.516	21.6	41.4	5357	3.25	6.06	6836	52.78	9330	subC
NP	14 /37 NPC 024	58.50	58.55	0.05	1.421	19.64	31.38	29.87	19.11	0.64	3261	3.61	1.584	39.0	37.2	4058	4.49	11.07	6653	60.98	8872	subC
NP	16 /37 NPC 025	182.00	182.05	0.05	1.543	13.98	39.20	28.79	18.03	0.63	3137	1.65	1.692	45.6	33.5	3647	1.92	5.26	6700	61.49	9803	subB
NP	19 /37 NPC 026	63.70	63.75	0.05	1.504	18.34	40.76	24.55	16.35	0.67	2765	0.93	1.696	49.9	30.1	3386	1.14	3.36	6760	60.02	8889	subC
NP	19 /37 NPC 027	128.50	128.55	0.05	1.348	20.88	29.24	28.04	21.84	0.78	3498	1.43	1.484	37.0	35.4	4421	1.81	4.09	7013	56.21	9204	subC
NP	19 /37 NPC 028	129.00	129.05	0.05	1.601	11.81	36.94	27.42	23.83	0.87	3031	5.02	1.741	41.9	31.1	3437	5.69	16.56	5914	53.50	9076	subC
NP	20 /37 NPC 029	75.50	75.55	0.05	1.328	30.25	11.68	28.35	29.72	1.05	4006	1.68	1.548	16.7	40.6	5743	2.41	4.19	6899	48.82	8243	ligA
NP	20 /37 NPC 030	76.00	76.05	0.05	1.321	28.35	11.88	28.87	30.90	1.07	4125	3.07	1.513	16.6	40.3	5757	4.28	7.44	6901	48.30	8507	subC
NP	24 /37 NPC 031	77.00	77.05	0.05	1.523	15.83	27.36	30.32	26.49	0.87	3487	5.65	1.689	32.5	36.0	4143	6.71	16.20	6138	53.37	8901	subC
NP	24 /37 NPC 032	68.00	68.05	0.05	1.407	20.79	28.14	28.35	22.72	0.80	3702	6.11	1.575	35.5	35.8	4674	7.71	16.50	7249	55.51	9597	subB
NP	25 /37 NPC 033	74.20	74.25	0.05	1.485	17.88	36.21	28.72	17.19	0.60	2907	6.96	1.660	44.1	35.0	3540	8.48	23.94	6332	62.56	8560	subC
NP	26 /37 NPC 034	26.80	26.85	0.05	1.367	20.37	29.32	34.13	16.18	0.47	3426	6.62	1.509	36.8	42.9	4302	8.31	19.32	6810	67.84	9021	subC
NP	27 /37 NPC 035	49.00	49.05	0.05	1.561	16.17	21.84	30.15	31.84	1.06	3824	8.36	1.750	26.1	36.0	4562	9.97	21.86	6169	48.64	9003	subC
NP	27 /37 NPC 036	56.00	56.05	0.05	1.667	12.69	44.92	24.97	17.42	0.70	2597	6.68	1.846	51.4	28.6	2974	7.65	25.72	6126	58.91	9078	subC
NP	27 /37 NPC 037	57.00	57.05	0.05	1.395	22.23	19.65	29.54	28.58	0.97	3947	4.37	1.573	25.3	38.0	5075	5.62	11.07	6791	50.83	9016	subC
NP	28 /37 NPC 038	86.50	86.55	0.05	1.824	10.10	57.91	18.56	13.43	0.72	2025	2.18	2.010	64.4	20.6	2253	2.42	10.77	6330	58.02	9752	subB
NP	29 /37 NPC 039	65.00	65.05	0.05	1.304	28.89	5.38	27.32	38.41	1.41	4661	0.55	1.488	7.6	38.4	6555	0.77	1.18	7091	41.56	8907	subC
NP	29 /37 NPC 040	66.50	66.55	0.05	1.333	22.96	16.75	29.76	30.53	1.03	4264	1.00	1.480	21.7	38.6	5535	1.30	2.35	7072	49.36	9372	subC
NP	33 /37 NPC 041	65.70	65.75	0.05	1.679	10.78	45.73	22.19	21.30	0.96	2719	6.08	1.829	51.3	24.9	3048	6.81	22.36	6252	51.02	9711	subB
NP	35 /37 NPC 042	38.00	38.05	0.05	1.259	21.47	7.05	36.05	35.43	0.98	5395	0.53	1.355	9.0	45.9	6870	0.67	0.98	7548	50.43	10516	subA
NP	35 /37 NPC 043	45.10	45.15	0.05	1.272	14.43	7.90	41.82	35.85	0.86	5812	0.46	1.333	9.2	48.9	6792	0.54	0.79	7483	53.84	11444	subA
NP	35 /37 NPC 044	190.00	190.05	0.05	1.276	11.06	9.98	42.73	36.23	0.85	5871	0.53	1.321	11.2	48.0	6601	0.60	0.90	7435	54.12	11853	?

Nong Plab Basin 2 / 2

hole No.		sample No.		analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
NP	36	/37 NPC	045	82.00	82.05	0.05	1.298	10.86	11.26	39.69	38.19	0.96	5562	1.05	1.347	12.6	44.5	6240	1.18	1.89	7142	50.96	11413	subA
NP	36	/37 NPC	046	83.00	83.05	0.05	1.312	8.76	16.60	40.94	33.70	0.82	5375	0.71	1.353	18.2	44.9	5891	0.78	1.32	7201	54.85	11801	?
NP	37	/37 NPC	047	40.80	40.85	0.05	1.392	18.59	25.23	29.95	26.23	0.88	3684	3.45	1.529	31.0	36.8	4525	4.24	9.36	6557	53.31	9115	subC
NP	37	/37 NPC	048	49.50	49.55	0.05	1.431	19.39	33.33	25.79	21.49	0.83	3058	2.79	1.597	41.3	32.0	3794	3.46	9.12	6468	54.55	8588	subC
NP	38	/37 NPC	049	53.50	53.55	0.05	1.358	22.66	18.83	31.86	26.65	0.84	3836	3.38	1.517	24.3	41.2	4960	4.37	8.81	6556	54.45	8657	subC
NP	38	/37 NPC	050	62.00	62.05	0.05	1.379	21.90	27.45	26.59	24.06	0.90	3535	1.96	1.543	35.1	34.0	4526	2.51	5.54	6979	52.50	9044	subC
NP	39	/37 NPC	051	75.00	75.05	0.05	1.448	16.63	32.13	29.77	21.47	0.72	3262	5.67	1.590	38.5	35.7	3913	6.80	17.38	6366	58.10	8987	subC
NP	40	/37 NPC	052	170.50	170.55	0.05	1.429	8.64	22.59	35.57	33.20	0.93	4747	3.34	1.489	24.7	38.9	5196	3.66	7.04	6903	51.72	11357	subA
NP	41	/37 NPC	053	80.00	80.05	0.05	1.462	16.92	38.42	25.88	18.78	0.73	2648	5.08	1.614	46.2	31.2	3187	6.11	19.18	5929	57.95	8099	ligA
NP	42	/37 NPC	054	87.10	87.15	0.05	1.440	15.52	39.19	25.97	19.32	0.74	2911	2.69	1.567	46.4	30.7	3446	3.18	9.24	6427	57.34	9085	subC

Mae Lamao Basin 1 / 9

hole		sample	analytical sample			as analysed basis								dry basis						dry ash free basis		ASTM class	
No.		No.	from	to	thick	SpGr	M	ASH	VM	FC	(FR)	CV	TS	SpGr	ASH	VM	CV	TS	TSmg/kcal	CV	VM	Btu/lb	Class
ML	1	/37 MLC 001	135.70	135.80	0.10	1.719	11.49	47.77	23.29	17.45	0.75	2882	1.28	1.896	54.0	26.3	3256	1.45	4.44	7074	57.17	10740	subA
ML	1	/37 MLC 002	136.10	136.20	0.10	1.489	13.17	27.39	28.06	31.38	1.12	3825	1.04	1.608	31.5	32.3	4405	1.20	2.72	6435	47.21	9783	subB
ML	1	/37 MLC 003	136.50	136.60	0.10	1.681	9.77	44.36	23.02	22.85	0.99	2791	1.23	1.815	49.2	25.5	3093	1.36	4.41	6085	50.19	9652	subB
ML	1	/37 MLC 004	136.80	136.90	0.10	1.406	13.41	8.23	34.77	43.59	1.25	5192	2.11	1.500	9.5	40.2	5996	2.44	4.06	6626	44.37	10272	subB
ML	1	/37 MLC 005	137.25	137.35	0.10	1.336	14.49	3.62	36.77	45.12	1.23	5576	0.53	1.417	4.2	43.0	6521	0.62	0.95	6809	44.90	10449	subB
ML	1	/37 MLC 006	137.75	137.85	0.10	1.448	13.01	25.88	28.35	32.76	1.16	4085	0.46	1.552	29.8	32.6	4696	0.53	1.13	6685	46.39	10209	subB
ML	1	/37 MLC 007	138.25	138.35	0.10	1.388	10.81	16.46	35.79	36.94	1.03	4925	0.52	1.456	18.5	40.1	5522	0.58	1.06	6772	49.21	10788	subA
ML	1	/37 MLC 008	138.75	138.85	0.10	1.759	6.87	47.29	26.61	19.23	0.72	2737	3.48	1.863	50.8	28.6	2939	3.74	12.71	5971	58.05	10109	subB
ML	1	/37 MLC 009	139.25	139.35	0.10	1.477	12.65	18.68	32.30	36.37	1.13	4444	0.53	1.587	21.4	37.0	5088	0.61	1.19	6472	47.04	10024	subB
ML	1	/37 MLC 010	139.75	139.85	0.10	1.409	13.62	7.48	35.58	43.32	1.22	5127	1.41	1.506	8.7	41.2	5935	1.63	2.75	6498	45.10	10048	subB
ML	1	/37 MLC 011	140.25	140.35	0.10	1.473	9.30	24.10	35.33	31.27	0.88	4384	2.03	1.548	26.6	39.0	4834	2.24	4.63	6583	53.05	10692	subA
ML	1	/37 MLC 012	140.75	140.85	0.10	1.557	10.53	19.48	35.57	34.42	0.97	4058	6.22	1.666	21.8	39.8	4536	6.95	15.33	5798	50.82	9258	subC
ML	1	/37 MLC 013	150.60	150.70	0.10	1.673	8.66	39.18	30.87	21.29	0.69	3226	2.75	1.787	42.9	33.8	3532	3.01	8.52	6185	59.18	10093	subB
ML	1	/37 MLC 014	151.15	151.25	0.10	1.732	9.60	53.16	22.88	14.36	0.63	2221	1.13	1.878	58.8	25.3	2457	1.25	5.09	5964	61.44	9392	subC
ML	1	/37 MLC 015	151.90	152.00	0.10	1.622	10.62	35.70	28.72	24.96	0.87	3332	2.47	1.751	39.9	32.1	3728	2.76	7.41	6207	53.50	9776	subB
ML	1	/37 MLC 016	154.05	154.15	0.10	1.441	15.21	22.02	31.15	31.62	1.02	3773	5.76	1.565	26.0	36.7	4450	6.79	15.27	6011	49.63	8903	subC
ML	1	/37 MLC 017	154.95	155.05	0.10	1.530	13.76	16.82	34.22	35.20	1.03	4275	5.71	1.671	19.5	39.7	4957	6.62	13.36	6158	49.29	9416	subC
ML	1	/37 MLC 018	172.95	173.00	0.05	1.870	6.59	38.91	35.87	18.63	0.52	3326	2.96	1.992	41.7	38.4	3561	3.17	8.90	6103	65.82	10362	subB
ML	1	/37 MLC 019	174.20	174.30	0.10	1.791	6.54	44.90	27.50	21.06	0.77	3068	1.85	1.896	48.0	29.4	3283	1.98	6.03	6318	56.63	10754	subA
ML	1	/37 MLC 020	174.70	174.80	0.10	1.813	7.97	38.14	28.42	25.47	0.90	3130	4.83	1.950	41.4	30.9	3401	5.25	15.43	5808	52.74	9603	subB
ML	3	/37 MLC 021	389.90	390.00	0.10	1.361	12.89	6.17	37.50	43.44	1.16	5711	1.96	1.438	7.1	43.0	6556	2.25	3.43	7056	46.33	11036	subA
ML	3	/37 MLC 022	390.90	391.00	0.10	1.562	8.66	31.89	37.28	22.17	0.59	3694	1.05	1.650	34.9	40.8	4044	1.15	2.84	6214	62.71	10152	subB
ML	3	/37 MLC 023	398.40	398.50	0.10	1.670	7.28	36.99	25.88	29.85	1.15	3608	3.53	1.763	39.9	27.9	3891	3.81	9.78	6474	46.44	10872	subA
ML	3	/37 MLC 024	398.80	398.90	0.10	1.382	10.19	14.76	37.49	37.56	1.00	5160	1.95	1.445	16.4	41.7	5745	2.17	3.78	6875	49.95	11075	subA
ML	5	/37 MLC 025	121.33	121.43	0.10	1.362	19.97	9.94	34.14	35.95	1.05	4690	2.55	1.497	12.4	42.7	5860	3.19	5.44	6691	48.71	9463	subC
ML	5	/37 MLC 026	121.73	121.83	0.10	1.395	16.17	10.89	34.39	38.55	1.12	4755	2.81	1.510	13.0	41.0	5672	3.35	5.91	6519	47.15	9711	subB
ML	5	/37 MLC 027	122.18	122.28	0.10	1.544	14.70	38.53	24.89	21.88	0.88	2727	1.74	1.704	45.2	29.2	3197	2.04	6.38	5831	53.22	8396	subC
ML	5	/37 MLC 028	122.34	122.44	0.10	1.318	19.49	7.71	30.85	41.95	1.36	4793	0.88	1.428	9.6	38.3	5953	1.09	1.84	6584	42.38	9413	subC
ML	5	/37 MLC 029	122.86	122.96	0.10	1.841	8.22	58.52	20.04	13.22	0.66	1835	1.23	1.991	63.8	21.8	1999	1.34	6.70	5517	60.25	8974	subC
ML	5	/37 MLC 030	123.21	123.31	0.10	1.504	14.37	35.24	27.94	22.45	0.80	2886	3.43	1.643	41.2	32.6	3370	4.01	11.88	5727	55.45	8365	subC
ML	5	/37 MLC 031	123.81	123.91	0.10	1.384	16.07	20.48	32.47	30.98	0.95	4146	2.64	1.494	24.4	38.7	4940	3.15	6.37	6534	51.17	9592	subB
ML	5	/37 MLC 032	124.14	124.24	0.10	1.607	12.00	40.64	25.95	21.41	0.83	2378	7.90	1.752	46.2	29.5	2702	8.98	33.22	5021	54.79	7506	ligA
ML	5	/37 MLC 033	124.68	124.78	0.10	1.574	9.75	43.21	25.09	21.95	0.87	2570	2.74	1.678	47.9	27.8	2848	3.04	10.66	5463	53.34	8662	subC
ML	7	/37 MLC 034	274.65	274.75	0.10	1.300	14.69	9.22	34.42	41.67	1.21	5230	1.01	1.371	10.8	40.3	6131	1.18	1.93	6873	45.24	10464	subB
ML	7	/37 MLC 035	274.95	275.05	0.10	1.360	13.85	18.47	30.52	37.16	1.22	4567	0.51	1.444	21.4	35.4	5301	0.59	1.12	6748	45.09	10273	subB
ML	7	/37 MLC 036	275.40	275.50	0.10	1.444	11.13	36.38	27.28	25.21	0.92	3551	0.45	1.529	40.9	30.7	3996	0.51	1.27	6765	51.97	10534	subA
ML	7	/37 MLC 037	275.90	276.00	0.10	1.368	12.96	22.82	30.27	33.95	1.12	4364	0.39	1.447	26.2	34.8	5014	0.45	0.89	6795	47.13	10428	subB
ML	7	/37 MLC 038	276.40	276.50	0.10	1.337	13.22	17.64	33.60	35.54	1.06	4725	0.38	1.409	20.3	38.7	5445	0.44	0.80	6834	48.60	10510	subA
ML	7	/37 MLC 039	276.90	277.00	0.10	1.289	14.83	8.45	35.87	40.85	1.14	5290	1.09	1.357	9.9	42.1	6211	1.28	2.06	6895	46.75	10487	subB
ML	7	/37 MLC 040	277.40	277.50	0.10	1.292	13.67	10.57	36.11	39.65	1.10	5280	0.72	1.355	12.2	41.8	6116	0.83	1.36	6969	47.66	10736	subA
ML	7	/37 MLC 041	277.90	278.00	0.10	1.565	11.97	32.18	25.88	29.97	1.16	3654	0.32	1.695	36.6	29.4	4151	0.36	0.88	6543	46.34	10083	subB
ML	7	/37 MLC 042	278.40	278.50	0.10	1.583	12.57	31.93	26.07	29.43	1.13	3665	0.34	1.728	36.5	29.8	4192	0.39	0.93	6604	46.97	10072	subB
ML	7	/37 MLC 043	278.90	279.00	0.10	1.537	13.60	27.23	27.24	31.93	1.17	3821	0.42	1.679	31.5	31.5	4422	0.49	1.10	6458	46.04	9745	subB
ML	7	/37 MLC 044	279.40	279.50	0.10	1.524	13.31	24.07	29.75	32.87	1.10	4170	0.29	1.657	27.8	34.3	4810	0.33	0.70	6659	47.51	10145	subB

hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML 7 /37	MLC 045	279.95	280.05	0.10	1.423	13.85	14.06	34.03	38.06	1.12	4983	1.04	1.527	16.3	39.5	5784	1.21	2.09	6912	47.20	10585	subA
ML 7 /37	MLC 046	280.45	280.55	0.10	1.425	15.42	15.94	32.11	36.53	1.14	4559	0.42	1.545	18.8	38.0	5390	0.50	0.92	6642	46.78	9915	subB
ML 7 /37	MLC 047	280.95	281.05	0.10	1.583	8.63	50.38	20.84	20.15	0.97	2529	0.38	1.675	55.1	22.8	2768	0.42	1.50	6170	50.84	9989	subB
ML 7 /37	MLC 048	281.45	281.55	0.10	1.773	9.14	48.80	23.19	18.87	0.81	2704	1.65	1.922	53.7	25.5	2976	1.82	6.10	6429	55.14	10314	subB
ML 7 /37	MLC 049	281.95	282.05	0.10	1.862	7.92	55.47	21.13	15.48	0.73	2163	1.59	2.011	60.2	22.9	2349	1.73	7.35	5908	57.72	9725	subB
ML 7 /37	MLC 050	282.60	282.70	0.10	1.741	8.95	47.28	23.22	20.55	0.89	2750	0.79	1.878	51.9	25.5	3020	0.87	2.87	6283	53.05	10124	subB
ML 7 /37	MLC 051	298.00	298.10	0.10	1.829	7.19	54.41	21.28	17.12	0.80	2437	0.33	1.955	58.6	22.9	2626	0.36	1.35	6346	55.42	10644	subA
ML 7 /37	MLC 052	298.60	298.70	0.10	1.823	8.47	49.49	21.88	20.16	0.92	2683	0.51	1.973	54.1	23.9	2931	0.56	1.90	6382	52.05	10382	subB
ML 7 /37	MLC 053	299.00	299.10	0.10	1.764	8.49	48.71	23.28	19.52	0.84	2665	0.51	1.899	53.2	25.4	2912	0.56	1.91	6227	54.39	10128	subB
ML 7 /37	MLC 054	299.50	299.60	0.10	1.705	8.47	43.28	25.85	22.40	0.87	3012	0.95	1.824	47.3	28.2	3291	1.04	3.15	6242	53.58	10191	subB
ML 7 /37	MLC 055	299.70	299.80	0.10	1.600	9.06	33.73	31.06	26.15	0.84	3744	1.74	1.702	37.1	34.2	4117	1.91	4.65	6544	54.29	10624	subA
ML 7 /37	MLC 056	300.20	300.30	0.10	1.478	12.35	21.59	30.77	35.29	1.15	4285	0.82	1.585	24.6	35.1	4889	0.94	1.91	6487	46.58	10064	subB
ML 7 /37	MLC 057	300.65	300.75	0.10	1.608	10.74	32.96	27.74	28.56	1.03	3633	1.26	1.735	36.9	31.1	4070	1.41	3.47	6453	49.27	10165	subB
ML 7 /37	MLC 058	301.15	301.25	0.10	1.363	12.97	7.67	36.52	42.84	1.17	5317	0.65	1.441	8.8	42.0	6109	0.75	1.22	6700	46.02	10440	subB
ML 7 /37	MLC 059	301.65	301.75	0.10	1.438	10.84	28.77	29.13	31.26	1.07	3918	2.38	1.519	32.3	32.7	4394	2.67	6.07	6488	48.24	10254	subB
ML 7 /37	MLC 060	302.00	302.10	0.10	1.563	8.99	41.93	24.58	24.50	1.00	3110	1.12	1.655	46.1	27.0	3417	1.23	3.60	6337	50.08	10244	subB
ML 7 /37	MLC 061	302.20	302.30	0.10	1.446	11.10	33.01	27.16	28.73	1.06	3676	0.58	1.531	37.1	30.6	4135	0.65	1.58	6577	48.60	10289	subB
ML 7 /37	MLC 062	302.60	302.70	0.10	1.506	11.03	34.70	25.80	28.47	1.10	3438	1.66	1.607	39.0	29.0	3864	1.87	4.83	6335	47.54	9910	subB
ML 7 /37	MLC 063	308.80	308.90	0.10	1.484	10.94	24.74	34.78	29.54	0.85	4090	5.68	1.578	27.8	39.1	4592	6.38	13.89	6359	54.07	10089	subB
ML 7 /37	MLC 064	309.40	309.50	0.10	1.712	7.81	43.85	24.32	24.02	0.99	2760	4.01	1.822	47.6	26.4	2994	4.35	14.53	5710	50.31	9452	subC
ML 8 /37	MLC 065	238.00	238.10	0.10	1.367	16.16	23.27	31.38	29.19	0.93	3660	6.09	1.471	27.8	37.4	4365	7.26	16.64	6043	51.81	8786	subC
ML 8 /37	MLC 066	238.50	238.60	0.10	1.471	13.94	43.16	22.22	20.68	0.93	2665	0.42	1.592	50.2	25.8	3097	0.49	1.58	6212	51.79	8985	subC
ML 8 /37	MLC 067	239.10	239.20	0.10	1.719	8.86	61.58	18.97	10.59	0.56	1779	0.23	1.848	67.6	20.8	1952	0.25	1.29	6018	64.17	9562	subB
ML 8 /37	MLC 068	239.50	239.60	0.10	1.504	13.98	38.56	24.24	23.22	0.96	3029	0.55	1.638	44.8	28.2	3521	0.64	1.82	6382	51.07	9344	subC
ML 8 /37	MLC 069	239.70	239.80	0.10	1.386	15.87	33.52	24.69	25.92	1.05	3289	0.74	1.495	39.8	29.3	3909	0.88	2.25	6499	48.78	9281	subC
ML 8 /37	MLC 070	240.25	240.55	0.30	1.342	17.38	13.27	32.18	37.17	1.16	4239	5.55	1.446	16.1	38.9	5131	6.72	13.09	6112	46.40	8900	subC
ML 8 /37	MLC 071	240.75	240.85	0.10	1.295	21.11	5.40	32.45	41.04	1.26	4948	0.96	1.406	6.8	41.1	6272	1.22	1.94	6733	44.16	9460	subC
ML 8 /37	MLC 072	241.25	241.25	0.00	1.351	19.65	16.76	29.60	33.99	1.15	4228	1.36	1.478	20.9	36.8	5262	1.69	3.22	6649	46.55	9294	subC
ML 8 /37	MLC 073	241.75	241.85	0.10	1.539	15.36	27.95	27.97	28.72	1.03	3575	2.72	1.706	33.0	33.0	4224	3.21	7.61	6306	49.34	9220	subC
ML 8 /37	MLC 074	242.30	242.40	0.10	1.699	11.56	46.54	23.08	18.82	0.82	2621	1.27	1.870	52.6	26.1	2964	1.44	4.85	6255	55.08	9491	subC
ML 8 /37	MLC 075	242.70	242.80	0.10	1.597	13.23	41.73	23.55	21.49	0.91	2803	1.42	1.757	48.1	27.1	3230	1.64	5.07	6223	52.29	9186	subC
ML 8 /37	MLC 076	243.85	243.95	0.10	1.610	13.15	39.90	25.66	21.29	0.83	3085	0.72	1.774	45.9	29.5	3552	0.83	2.33	6571	54.65	9763	subB
ML 8 /37	MLC 077	245.90	246.00	0.10	1.597	12.13	37.00	26.62	24.25	0.91	3086	2.12	1.740	42.1	30.3	3512	2.41	6.87	6066	52.33	9255	subC
ML 8 /37	MLC 078	246.35	246.45	0.10	1.424	16.73	20.43	29.68	33.16	1.12	4024	3.06	1.557	24.5	35.6	4832	3.67	7.60	6404	47.23	9298	subC
ML 8 /37	MLC 079	246.80	246.90	0.10	1.419	18.29	12.18	31.13	38.40	1.23	4141	3.36	1.566	14.9	38.1	5068	4.11	8.11	5956	44.77	8572	subC
ML 8 /37	MLC 080	247.25	247.35	0.10	1.416	15.22	20.77	32.25	31.76	0.98	4178	4.12	1.530	24.5	38.0	4928	4.86	9.86	6527	50.38	9713	subB
ML 8 /37	MLC 081	247.70	247.80	0.10	1.890	8.28	60.52	19.14	12.06	0.63	1692	2.69	2.055	66.0	20.9	1845	2.93	15.90	5423	61.35	8779	subC
ML 8 /37	MLC 082	250.80	250.90	0.10	1.762	10.16	54.56	20.31	14.97	0.74	2182	0.71	1.928	60.7	22.6	2429	0.79	3.25	6185	57.57	9566	subB
ML 8 /37	MLC 083	252.00	252.10	0.10	1.627	12.26	36.40	25.62	25.72	1.00	2883	4.21	1.783	41.5	29.2	3286	4.80	14.60	5616	49.90	8530	subC
ML 8 /37	MLC 084	252.42	252.52	0.10	1.824	8.40	54.32	21.96	15.32	0.70	2276	1.32	1.973	59.3	24.0	2485	1.44	5.80	6105	58.91	9926	subB
ML 8 /37	MLC 085	252.84	252.94	0.10	1.639	11.54	36.88	26.52	25.06	0.94	3017	3.96	1.788	41.7	30.0	3411	4.48	13.13	5849	51.42	9023	subC
ML 8 /37	MLC 086	253.30	253.40	0.10	1.515	13.65	33.41	27.02	25.92	0.96	3406	1.95	1.649	38.7	31.3	3944	2.26	5.73	6434	51.04	9600	subB
ML 8 /37	MLC 087	255.70	255.80	0.10	1.648	10.65	42.00	28.78	18.57	0.65	2193	2.14	1.786	47.0	32.2	2454	2.40	9.76	4631	60.78	7183	ligA
ML 8 /37	MLC 088	278.40	278.50	0.10	1.799	8.88	50.79	22.06	18.27	0.83	2163	5.08	1.951	55.7	24.2	2374	5.58	23.49	5363	54.70	8593	subC

hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML	8 /37 MLC 089	278.84	278.94	0.10	1.640	10.51	38.08	26.35	25.06	0.95	2695	7.01	1.773	42.6	29.4	3012	7.83	26.01	5242	51.25	8180	ligA
ML	8 /37 MLC 090	317.45	317.55	0.10	1.637	10.29	38.22	26.02	25.47	0.98	2843	5.49	1.766	42.6	29.0	3169	6.12	19.31	5521	50.53	8694	subC
ML	11 /37 MLC 091	151.00	151.10	0.10	1.934	5.41	78.71	10.74	5.14	0.48	760	0.42	2.043	83.2	11.4	803	0.44	5.53	4786	67.63	9125	subC
ML	11 /37 MLC 092	151.55	151.65	0.10	1.491	11.68	39.91	23.67	24.74	1.05	2906	1.02	1.595	45.2	26.8	3290	1.15	3.51	6003	48.89	9194	subC
ML	11 /37 MLC 093	152.10	152.20	0.10	1.596	10.55	48.31	20.39	20.75	1.02	2541	0.33	1.717	54.0	22.8	2841	0.37	1.30	6176	49.56	9565	subB
ML	11 /37 MLC 094	163.35	163.45	0.10	1.658	13.61	39.22	24.67	22.50	0.91	2829	2.07	1.850	45.4	28.6	3275	2.40	7.32	5997	52.30	8829	subC
ML	12 /37 MLC 095	162.80	162.85	0.05	1.332	22.09	5.93	31.94	40.04	1.25	5082	1.66	1.470	7.6	41.0	6523	2.13	3.27	7060	44.37	9780	subB
ML	12 /37 MLC 096	163.30	163.35	0.05	1.313	21.35	6.13	34.72	37.80	1.09	5133	0.64	1.435	7.8	44.1	6526	0.81	1.25	7078	47.88	9897	subB
ML	12 /37 MLC 097	163.95	164.00	0.05	1.614	18.11	38.62	24.81	18.46	0.74	2875	0.69	1.868	47.2	30.3	3511	0.84	2.40	6644	57.34	8877	subC
ML	12 /37 MLC 098	169.00	169.05	0.05	1.625	16.75	45.56	20.51	17.18	0.84	2396	0.58	1.859	54.7	24.6	2878	0.70	2.42	6357	54.42	8487	subC
ML	12 /37 MLC 099	169.75	169.80	0.05	1.470	18.94	25.59	26.88	28.59	1.06	3721	2.02	1.651	31.6	33.2	4590	2.49	5.43	6708	48.46	9258	subC
ML	12 /37 MLC 100	170.65	170.70	0.05	1.419	21.46	21.78	27.60	29.16	1.06	3692	1.29	1.602	27.7	35.1	4701	1.64	3.49	6505	48.63	8686	subC
ML	12 /37 MLC 101	171.40	171.45	0.05	1.434	18.99	27.08	27.28	26.65	0.98	3660	3.10	1.596	33.4	33.7	4518	3.83	8.47	6787	50.58	9317	subC
ML	12 /37 MLC 102	171.95	172.00	0.05	1.499	16.76	33.72	26.50	23.02	0.87	3428	1.94	1.666	40.5	31.8	4118	2.33	5.66	6922	53.51	9715	subB
ML	12 /37 MLC 103	173.55	173.60	0.05	1.688	15.72	38.24	23.43	22.61	0.97	2329	12.99	1.937	45.4	27.8	2763	15.41	55.78	5059	50.89	6872	ligA
ML	12 /37 MLC 104	174.00	174.05	0.05	1.693	15.59	39.28	24.04	21.09	0.88	2485	8.75	1.941	46.5	28.5	2944	10.37	35.21	5506	53.27	7648	ligA
ML	12 /37 MLC 105	174.50	174.55	0.05	1.373	19.71	14.43	34.28	31.58	0.92	4610	2.95	1.511	18.0	42.7	5742	3.67	6.40	7000	52.05	9844	subB
ML	12 /37 MLC 106	174.95	175.00	0.05	1.653	18.36	43.53	21.70	16.41	0.76	2404	3.41	1.938	53.3	26.6	2945	4.18	14.18	6308	56.94	8133	ligA
ML	12 /37 MLC 107	180.05	180.10	0.05	1.642	18.25	50.46	19.45	11.84	0.61	1872	1.52	1.917	61.7	23.8	2290	1.86	8.12	5983	62.16	7374	ligA
ML	12 /37 MLC 108	180.70	180.75	0.05	1.628	17.53	39.46	25.20	17.81	0.71	2332	4.70	1.879	47.8	30.6	2828	5.70	20.15	5422	58.59	7231	ligA
ML	12 /37 MLC 109	181.30	181.35	0.05	1.763	15.83	49.84	20.76	13.57	0.65	1779	4.92	2.058	59.2	24.7	2114	5.85	27.66	5182	60.47	6801	ligA
ML	13 /37 MLC 110	185.80	185.85	0.05	1.522	17.34	32.66	24.99	25.01	1.00	3229	1.50	1.709	39.5	30.2	3906	1.81	4.65	6458	49.98	8978	subC
ML	13 /37 MLC 111	186.10	186.15	0.05	1.591	17.24	35.92	23.88	22.96	0.96	3058	1.04	1.814	43.4	28.9	3695	1.26	3.40	6529	50.98	8992	subC
ML	13 /37 MLC 112	186.80	186.85	0.05	1.582	16.55	34.45	24.54	24.46	1.00	2950	1.43	1.788	41.3	29.4	3535	1.71	4.85	6020	50.08	8448	subC
ML	13 /37 MLC 113	205.75	205.80	0.05	1.352	18.17	9.30	35.96	36.57	1.02	4931	1.78	1.467	11.4	43.9	6026	2.18	3.61	6799	49.58	9875	subB
ML	13 /37 MLC 114	206.20	206.25	0.05	1.602	13.74	38.95	25.03	22.28	0.89	2996	1.68	1.772	45.2	29.0	3473	1.95	5.61	6333	52.91	9312	subC
ML	13 /37 MLC 115	206.65	206.70	0.05	1.532	17.67	31.20	26.84	24.29	0.90	2870	6.57	1.729	37.9	32.6	3486	7.98	22.89	5613	52.49	7716	ligA
ML	13 /37 MLC 116	208.35	208.40	0.05	1.589	16.09	43.12	23.69	17.10	0.72	2355	2.38	1.791	51.4	28.2	2807	2.84	10.11	5773	58.08	7905	ligA
ML	13 /37 MLC 117	209.95	210.00	0.05	1.420	18.24	25.08	27.58	29.10	1.06	3653	1.05	1.567	30.7	33.7	4468	1.28	2.87	6445	48.66	9017	subC
ML	13 /37 MLC 118	210.40	210.45	0.05	1.387	20.13	19.68	28.46	31.73	1.11	3992	1.07	1.537	24.6	35.6	4998	1.34	2.68	6632	47.28	9125	subC
ML	13 /37 MLC 119	210.95	211.00	0.05	1.474	13.49	25.60	31.69	29.22	0.92	3724	4.14	1.592	29.6	36.6	4305	4.79	11.12	6114	52.03	9270	subC
ML	13 /37 MLC 120	211.35	211.40	0.05	1.594	14.67	33.35	26.50	25.48	0.96	3090	4.30	1.775	39.1	31.1	3621	5.04	13.92	5945	50.98	8678	subC
ML	13 /37 MLC 121	212.15	212.20	0.05	1.873	9.69	57.76	19.53	13.02	0.67	1797	2.20	2.067	64.0	21.6	1990	2.44	12.24	5521	60.00	8582	subC
ML	13 /37 MLC 122	215.50	215.55	0.05	1.635	12.95	49.86	22.15	15.04	0.68	2073	2.33	1.806	57.3	25.4	2381	2.68	11.24	5574	59.56	8056	ligA
ML	13 /37 MLC 123	217.95	218.00	0.05	1.611	14.47	28.94	28.01	28.58	1.02	3247	5.45	1.797	33.8	32.7	3796	6.37	16.78	5738	49.50	8475	subC
ML	13 /37 MLC 124	218.25	218.30	0.05	1.472	16.18	21.80	31.83	30.19	0.95	3974	3.83	1.620	26.0	38.0	4741	4.57	9.64	6408	51.32	9363	subC
ML	13 /37 MLC 125	218.60	218.65	0.05	1.426	18.00	16.96	34.21	30.83	0.90	4366	3.76	1.573	20.7	41.7	5324	4.59	8.61	6713	52.60	9635	subB
ML	13 /37 MLC 126	219.05	219.10	0.05	1.736	11.19	49.91	23.17	15.73	0.68	2540	1.72	1.913	56.2	26.1	2860	1.94	6.77	6530	59.56	9936	subB
ML	13 /37 MLC 127	236.25	236.30	0.05	1.763	7.52	54.87	22.84	14.77	0.65	2034	1.71	1.880	59.3	24.7	2199	1.85	8.41	5408	60.73	8384	subC
ML	13 /37 MLC 128	255.46	255.50	0.04	1.500	9.57	32.01	33.65	24.77	0.74	3446	2.17	1.584	35.4	37.2	3811	2.40	6.30	5899	57.60	9487	subC
ML	13 /37 MLC 129	255.90	255.95	0.05	1.842	11.39	57.90	18.13	12.58	0.69	1754	1.73	2.066	65.3	20.5	1979	1.95	9.86	5711	59.04	8409	subC
ML	14 /37 MLC 130	182.45	182.50	0.05	1.454	17.17	27.75	28.17	26.91	0.96	3556	1.20	1.605	33.5	34.0	4293	1.45	3.37	6456	51.14	9141	subC
ML	14 /37 MLC 131	182.90	182.95	0.05	1.419	16.51	28.08	27.33	28.08	1.03	3647	1.34	1.547	33.6	32.7	4368	1.60	3.67	6582	49.32	9425	subC
ML	14 /37 MLC 132	183.10	183.15	0.05	1.367	18.61	15.89	30.65	34.85	1.14	4381	0.75	1.492	19.5	37.7	5383	0.92	1.71	6689	46.79	9522	subB

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hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML 14	/37 MLC 133	210.20	210.25	0.05	1.464	14.01	35.79	27.86	22.34	0.80	3246	0.65	1.584	41.6	32.4	3775	0.76	2.00	6466	55.50	9527	subB
ML 14	/37 MLC 134	211.85	211.90	0.05	1.471	15.63	34.81	25.52	24.04	0.94	3194	0.54	1.612	41.3	30.2	3786	0.64	1.69	6445	51.49	9213	subC
ML 14	/37 MLC 135	212.15	212.20	0.05	1.376	17.28	18.75	32.54	31.43	0.97	4287	0.56	1.493	22.7	39.3	5183	0.68	1.31	6702	50.87	9678	subB
ML 14	/37 MLC* 136	212.50	212.55	0.05	1.338	21.58	11.92	31.07	35.43	1.14	4438	0.99	1.475	15.2	39.6	5659	1.26	2.23	6674	46.72	9169	subC
ML 14	/37 MLC 137	213.30	213.35	0.05	1.495	17.38	38.12	23.39	21.11	0.90	2738	1.86	1.669	46.1	28.3	3314	2.25	6.79	6153	52.56	8365	subC
ML 14	/37 MLC 138	214.60	214.65	0.05	1.658	12.82	51.61	21.63	13.94	0.64	2108	2.54	1.836	59.2	24.8	2418	2.91	12.05	5926	60.81	8556	subC
ML 14	/37 MLC 139	214.95	215.00	0.05	1.444	19.28	24.01	28.95	27.76	0.96	3706	2.32	1.615	29.7	35.9	4591	2.87	6.26	6535	51.05	9005	subC
ML 14	/37 MLC 140	215.20	215.25	0.05	1.440	19.22	19.93	25.87	34.98	1.35	3329	1.80	1.608	24.7	32.0	4121	2.23	5.41	5471	42.51	7617	ligA
ML 14	/37 MLC 141	215.60	215.65	0.05	1.587	15.50	31.61	26.75	26.14	0.98	3143	6.39	1.778	37.4	31.7	3720	7.56	20.33	5943	50.58	8562	subC
ML 14	/37 MLC 142	216.05	216.10	0.05	1.316	18.22	13.03	34.44	34.31	1.00	4558	4.14	1.416	15.9	42.1	5573	5.06	9.08	6630	50.09	9560	subB
ML 14	/37 MLC 143	221.10	221.15	0.05	1.484	12.97	43.13	24.44	19.46	0.80	3251	0.90	1.599	49.6	28.1	3735	1.03	2.77	7405	55.67	10972	subA
ML 14	/37 MLC 144	222.75	222.80	0.05	1.481	14.10	40.83	25.67	19.40	0.76	2860	2.22	1.608	47.5	29.9	3329	2.58	7.76	6346	56.96	9211	subC
ML 14	/37 MLC 145	223.30	223.35	0.05	1.547	13.59	46.32	21.91	18.18	0.83	2564	0.88	1.693	53.6	25.4	2967	1.02	3.43	6396	54.65	9237	subC
ML 14	/37 MLC 146	223.70	223.75	0.05	1.360	15.78	25.91	28.43	29.88	1.05	3848	2.39	1.458	30.8	33.8	4569	2.84	6.21	6599	48.76	9627	subB
ML 14	/37 MLC 147	243.55	243.60	0.05	1.959	9.11	48.32	36.99	5.58	0.15	2198	2.27	2.167	53.2	40.7	2418	2.50	10.33	5163	86.89	8253	ligA
ML 17	/37 MLC 148	67.38	67.45	0.07	1.301	23.58	9.42	29.75	37.25	1.25	4468	0.73	1.434	12.3	38.9	5847	0.96	1.63	6669	44.40	8953	subC
ML 17	/37 MLC 149	68.00	68.10	0.10	1.445	18.12	34.25	25.67	21.96	0.86	3166	2.18	1.603	41.8	31.4	3867	2.66	6.89	6647	53.89	9043	subC
ML 17	/37 MLC 150	71.65	71.70	0.05	1.366	22.84	21.63	28.88	26.65	0.92	3692	3.25	1.532	28.0	37.4	4785	4.21	8.80	6649	52.01	8661	subC
ML 19	/37 MLC 151	9.70	9.75	0.05	1.341	24.66	11.74	32.72	30.88	0.94	4168	3.47	1.509	15.6	43.4	5532	4.61	8.33	6553	51.45	8581	subC
ML 23	/37 MLC 152	67.65	67.70	0.05	1.736	13.50	59.51	16.21	10.78	0.67	1642	1.16	1.961	68.8	18.7	1898	1.34	7.06	6084	60.06	8257	ligA
ML 23	/37 MLC 153	68.00	68.05	0.05	1.304	23.75	7.50	33.41	35.34	1.06	4791	2.35	1.440	9.8	43.8	6283	3.08	4.91	6969	48.60	9388	subC
ML 23	/37 MLC 154	68.45	68.50	0.05	1.313	19.14	12.03	33.13	35.70	1.08	4722	2.77	1.418	14.9	41.0	5840	3.43	5.87	6860	48.13	9781	subB
ML 23	/37 MLC 155	69.15	69.20	0.05	1.314	24.35	12.02	30.41	33.22	1.09	4437	1.88	1.462	15.9	40.2	5865	2.49	4.24	6973	47.79	9179	subC
ML 23	/37 MLC 156	69.65	69.70	0.05	1.356	20.75	11.97	32.16	35.12	1.09	4377	3.68	1.495	15.1	40.6	5523	4.64	8.41	6506	47.80	9047	subC
ML 23	/37 MLC 157	70.90	70.95	0.05	1.304	21.98	10.01	31.83	36.18	1.14	4669	3.09	1.426	12.8	40.8	5984	3.96	6.62	6865	46.80	9429	subC
ML 23	/37 MLC 158	70.28	70.35	0.07	1.431	18.27	26.03	27.28	28.42	1.04	3694	4.02	1.584	31.8	33.4	4520	4.92	10.88	6632	48.98	9254	subC
ML 23	/37 MLC 159	81.83	81.88	0.05	1.383	22.11	14.39	30.57	32.93	1.08	4258	3.51	1.552	18.5	39.2	5467	4.51	8.24	6706	48.14	9074	subC
ML 23	/37 MLC 160	82.89	82.94	0.05	1.378	17.90	24.47	28.64	28.99	1.01	3797	2.40	1.502	29.8	34.9	4625	2.92	6.32	6589	49.70	9293	subC
ML 23	/37 MLC 161	83.00	83.05	0.05	1.518	18.14	38.45	23.48	19.93	0.85	2839	2.11	1.715	47.0	28.7	3468	2.58	7.43	6540	54.09	8732	subC
ML 24	/37 MLC 162	55.70	55.75	0.05	1.435	18.62	30.12	26.38	24.88	0.94	3330	0.48	1.594	37.0	32.4	4092	0.59	1.44	6496	51.46	8883	subC
ML 24	/37 MLC 163	56.05	56.10	0.05	1.512	17.41	38.66	22.93	21.00	0.92	2672	1.01	1.695	46.8	27.8	3235	1.22	3.78	6082	52.20	8249	ligA
ML 24	/37 MLC 164	56.40	56.45	0.05	1.632	12.89	59.68	15.69	11.74	0.75	1427	0.36	1.800	68.5	18.0	1638	0.41	2.52	5202	57.20	7216	ligA
ML 24	/37 MLC 165	59.55	59.60	0.05	1.422	19.09	27.60	26.85	26.46	0.99	3199	5.56	1.579	34.1	33.2	3954	6.87	17.38	6001	50.37	8163	ligA
ML 24	/37 MLC 166	59.95	60.00	0.05	1.436	17.67	29.08	27.96	25.29	0.90	3458	2.13	1.584	35.3	34.0	4200	2.59	6.16	6494	52.51	9074	subC
ML 24	/37 MLC 167	61.85	61.90	0.05	1.628	15.32	46.55	22.85	15.28	0.67	2113	3.50	1.837	55.0	27.0	2495	4.13	16.56	5542	59.93	7591	ligA
ML 24	/37 MLC 168	69.70	69.75	0.05	1.366	21.84	21.16	28.89	28.11	0.97	3529	5.40	1.522	27.1	37.0	4515	6.91	15.30	6191	50.68	8200	ligA
ML 24	/37 MLC 169	70.20	70.25	0.05	1.474	10.44	30.98	36.18	22.40	0.62	2856	9.63	1.560	34.6	40.4	3189	10.75	33.72	4875	61.76	7608	ligA
ML 24	/37 MLC 170	70.50	70.55	0.05	1.605	10.40	50.05	23.16	16.39	0.71	2300	3.96	1.726	55.9	25.8	2567	4.42	17.22	5815	58.56	9007	subC
ML 24	/37 MLC 171	70.80	70.85	0.05	1.517	14.04	39.04	26.76	20.16	0.75	2516	5.83	1.657	45.4	31.1	2927	6.78	23.17	5362	57.03	7756	ligA
ML 24	/37 MLC 172	81.60	81.65	0.05	1.487	16.30	37.11	25.06	21.53	0.86	2990	1.37	1.643	44.3	29.9	3572	1.64	4.58	6418	53.79	8980	subC
ML 25	/37 MLC 173	88.93	89.00	0.07	1.445	23.00	26.38	25.62	25.00	0.98	3320	4.31	1.667	34.3	33.3	4312	5.60	12.98	6559	50.61	8332	subC
ML 25	/37 MLC 174	89.35	89.40	0.05	1.463	16.46	38.55	27.14	17.85	0.66	2675	4.67	1.610	46.1	32.5	3202	5.59	17.46	5946	60.32	8211	ligA
ML 25	/37 MLC 175	89.70	89.75	0.05	1.346	21.88	19.14	28.74	30.24	1.05	3390	6.47	1.490	24.5	36.8	4339	8.28	19.09	5748	48.73	7626	ligA
ML 25	/37 MLC 176	90.55	90.60	0.05	1.424	22.08	32.16	24.14	21.62	0.90	3034	3.82	1.618	41.3	31.0	3894	4.90	12.59	6630	52.75	8343	subC

hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML 25	/37 MLC 177	91.45	91.50	0.05	1.349	19.73	12.41	32.82	35.04	1.07	3996	6.21	1.476	15.5	40.9	4978	7.74	15.54	5889	48.36	8274	ligA
ML 25	/37 MLC 178	91.85	91.90	0.05	1.344	20.84	19.23	29.74	30.19	1.02	3808	2.59	1.478	24.3	37.6	4811	3.27	6.80	6354	49.62	8643	subC
ML 25	/37 MLC 179	92.25	92.30	0.05	1.248	25.22	5.13	34.00	35.65	1.05	5038	1.67	1.362	6.9	45.5	6737	2.23	3.31	7233	48.82	9605	subB
ML 25	/37 MLC 180	107.70	107.75	0.05	1.690	7.96	52.83	22.48	16.73	0.74	2158	6.10	1.797	57.4	24.4	2345	6.63	28.27	5504	57.33	9041	subC
ML 25	/37 MLC 181	108.15	108.25	0.10	1.453	19.36	17.14	31.85	31.65	0.99	3721	5.53	1.630	21.3	39.5	4614	6.86	14.86	5860	50.16	8185	ligA
ML 25	/37 MLC 182	108.85	108.90	0.05	1.597	14.66	28.16	28.54	28.64	1.00	3268	7.56	1.779	33.0	33.4	3829	8.86	23.13	5715	49.91	8413	subC
ML 25	/37 MLC 183	109.30	109.35	0.05	1.384	23.97	19.19	27.56	29.28	1.06	3858	2.58	1.575	25.2	36.2	5074	3.39	6.69	6787	48.49	8754	subC
ML 25	/37 MLC 184	109.70	109.75	0.05	1.435	16.25	21.22	32.79	29.74	0.91	3691	7.17	1.567	25.3	39.2	4407	8.56	19.43	5903	52.44	8594	subC
ML 25	/37 MLC 185	109.90	109.95	0.05	1.376	16.91	15.55	32.22	35.32	1.10	4278	1.70	1.490	18.7	38.8	5149	2.05	3.97	6334	47.71	9256	subC
ML 25	/37 MLC 186	110.20	110.28	0.08	1.651	14.10	40.68	29.90	15.32	0.51	2534	0.88	1.849	47.4	34.8	2950	1.02	3.47	5604	66.12	8127	ligA
ML 25	/37 MLC 187	110.55	110.60	0.05	1.363	16.22	12.98	34.48	36.32	1.05	4361	4.78	1.466	15.5	41.2	5205	5.71	10.96	6160	48.70	9131	subC
ML 25	/37 MLC 188	110.85	110.90	0.05	1.538	13.80	21.61	32.74	31.85	0.97	3291	8.86	1.683	25.1	38.0	3818	10.28	26.92	5095	50.69	7635	ligA
ML 25	/37 MLC 189	111.35	111.40	0.05	1.421	15.10	18.93	32.43	33.54	1.03	4062	4.28	1.536	22.3	38.2	4784	5.04	10.54	6157	49.16	9194	subC
ML 25	/37 MLC 190	112.40	112.50	0.10	1.569	16.17	39.74	24.89	19.20	0.77	2597	3.64	1.762	47.4	29.7	3098	4.34	14.02	5890	56.45	8157	ligA
ML 1	/38 MLC 001	71.35	71.40	0.05	1.812	6.30	53.04	22.99	17.67	0.77	2430	0.64	1.917	56.6	24.5	2593	0.68	2.63	5976	56.54	10249	subB
ML 1	/38 MLC 002	71.95	72.00	0.05	1.548	8.60	34.78	28.64	27.98	0.98	3412	1.27	1.632	38.1	31.3	3733	1.39	3.72	6026	50.58	9845	subB
ML 1	/38 MLC 003	72.43	72.48	0.05	1.489	9.84	27.83	31.57	30.76	0.97	4192	0.77	1.573	30.9	35.0	4650	0.85	1.84	6725	50.65	10798	subA
ML 1	/38 MLC 004	72.95	73.00	0.05	1.555	9.54	41.00	26.27	23.19	0.88	3034	0.56	1.652	45.3	29.0	3354	0.62	1.85	6134	53.11	9805	subB
ML 1	/38 MLC 005	73.35	73.40	0.05	1.590	8.84	29.82	31.52	29.82	0.95	3599	4.23	1.686	32.7	34.6	3948	4.64	11.75	5867	51.39	9572	subB
ML 1	/38 MLC 006	73.95	74.40	0.45	1.715	8.86	36.02	33.25	21.87	0.66	2759	11.40	1.843	39.5	36.5	3027	12.51	41.32	5005	60.32	8018	ligA
ML 1	/38 MLC 008	83.00	83.05	0.05	1.431	16.08	25.57	33.82	24.53	0.73	3429	3.95	1.560	30.5	40.3	4086	4.71	11.52	5877	57.96	8510	subC
ML 2	/38 MLC 009	132.75	132.80	0.05	1.528	9.01	37.72	31.12	22.15	0.71	3204	0.86	1.612	41.5	34.2	3521	0.95	2.68	6015	58.42	9737	subB
ML 2	/38 MLC 010	132.20	132.25	0.05	1.545	8.82	34.43	31.18	25.57	0.82	3553	1.84	1.631	37.8	34.2	3897	2.02	5.18	6261	54.94	10199	subB
ML 2	/38 MLC 011	133.70	133.75	0.05	1.454	13.58	38.78	27.33	20.31	0.74	3111	1.07	1.566	44.9	31.6	3600	1.24	3.44	6530	57.37	9641	subB
ML 2	/38 MLC 012	134.15	134.20	0.05	1.575	11.95	48.24	21.70	18.11	0.83	2314	0.64	1.708	54.8	24.6	2628	0.73	2.77	5813	54.51	8693	subC
ML 2	/38 MLC 013	134.75	134.80	0.05	1.438	14.89	28.52	29.88	26.71	0.89	3593	0.87	1.557	33.5	35.1	4222	1.02	2.42	6349	52.80	9348	subC
ML 2	/38 MLC 014	135.25	135.29	0.04	1.809	8.57	56.13	22.92	12.38	0.54	2091	1.07	1.957	61.4	25.1	2287	1.17	5.12	5924	64.93	9565	subB
ML 2	/38 MLC 015	136.00	136.05	0.05	1.310	21.54	8.55	31.73	38.18	1.20	4783	0.76	1.432	10.9	40.4	6096	0.97	1.59	6842	45.39	9487	subC
ML 2	/38 MLC 016	136.70	136.75	0.05	1.425	16.77	22.85	30.40	29.98	0.99	3834	0.61	1.558	27.5	36.5	4607	0.73	1.59	6350	50.35	9163	subC
ML 2	/38 MLC 018	137.90	137.95	0.05	1.456	13.95	19.18	31.48	35.39	1.12	3164	2.82	1.572	22.3	36.6	3677	3.28	8.91	4732	47.08	7145	ligA
ML 2	/38 MLC 019	138.50	138.55	0.05	1.488	13.12	22.76	33.40	30.72	0.92	3657	4.30	1.606	26.2	38.4	4209	4.95	11.76	5703	52.09	8716	subC
ML 2	/38 MLC 161	138.60	138.65	0.05	1.537	14.11	40.16	26.42	19.31	0.73	2678	2.41	1.686	46.8	30.8	3118	2.81	9.00	5856	57.77	8499	subC
ML 2	/38 MLC 162	139.15	139.20	0.05	1.711	11.47	53.47	20.87	14.19	0.68	1986	0.94	1.885	60.4	23.6	2243	1.06	4.73	5665	59.53	8453	subC
ML 2	/38 MLC 163	139.70	139.75	0.05	1.456	13.98	47.05	22.91	16.06	0.70	2424	0.87	1.573	54.7	26.6	2818	1.01	3.59	6220	58.79	8869	subC
ML 2	/38 MLC 164	140.25	140.30	0.05	1.572	13.97	42.53	25.61	17.89	0.70	2282	3.22	1.733	49.4	29.8	2653	3.74	14.11	5246	58.87	7547	ligA
ML 2	/38 MLC 165	140.80	140.85	0.05	1.620	13.53	41.02	26.52	18.93	0.71	2268	4.62	1.794	47.4	30.7	2623	5.34	20.37	4990	58.35	7245	ligA
ML 2	/38 MLC 166	141.35	141.40	0.05	1.336	22.49	19.08	33.70	24.73	0.73	4487	2.60	1.480	24.6	43.5	5789	3.35	5.79	7679	57.68	10193	subB
ML 2	/38 MLC 167	141.90	141.95	0.05	1.460	17.12	18.51	35.81	28.56	0.80	3673	5.56	1.613	22.3	43.2	4432	6.71	15.14	5706	55.63	8230	ligA
ML 2	/38 MLC 168	142.45	142.50	0.05	1.456	14.32	26.26	32.94	26.48	0.80	3088	5.19	1.576	30.6	38.4	3604	6.06	16.81	5197	55.44	7704	ligA
ML 2	/38 MLC 169	143.00	143.05	0.05	1.634	14.14	39.81	27.82	18.23	0.66	2206	6.35	1.824	46.4	32.4	2569	7.40	28.79	4790	60.41	6827	ligA
ML 2	/38 MLC 171	145.00	145.05	0.05	1.686	9.11	57.14	22.28	11.47	0.51	1921	2.22	1.810	62.9	24.5	2114	2.44	11.56	5692	66.01	9029	subC
ML 4	/38 MLC 020	86.75	86.87	0.12	1.605	7.97	44.27	28.04	19.72	0.70	2878	3.32	1.694	48.1	30.5	3127	3.61	11.54	6026	58.71	9957	subB
ML 4	/38 MLC 021	87.10	87.15	0.05	1.937	9.76	64.84	18.15	7.25	0.40	1143	1.41	2.155	71.9	20.1	1267	1.56	12.34	4500	71.46	6805	ligA
ML 4	/38 MLC 022	87.70	87.75	0.05	1.508	11.70	48.86	23.32	16.12	0.69	2108	1.94	1.617	55.3	26.4	2387	2.20	9.20	5345	59.13	8009	ligA

hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML 7	/38 MLC 023	84.95	85.00	0.05	1.369	14.55	15.62	35.01	34.82	0.99	4645	2.64	1.461	18.3	41.0	5436	3.09	5.68	6652	50.14	10075	subB
ML 8	/38 MLC 024	241.00	241.05	0.05	1.301	13.82	5.23	36.95	44.00	1.19	5516	0.75	1.367	6.1	42.9	6401	0.87	1.36	6814	45.65	10529	subA
ML 8	/38 MLC 025	241.50	241.55	0.05	1.337	15.21	9.01	35.23	40.55	1.15	4989	0.55	1.423	10.6	41.5	5884	0.65	1.10	6584	46.49	9951	subB
ML 8	/38 MLC 026	242.00	242.05	0.05	1.459	11.68	25.09	30.31	32.92	1.09	4182	0.63	1.553	28.4	34.3	4735	0.71	1.51	6614	47.94	10331	subB
ML 8	/38 MLC 027	242.50	242.55	0.05	1.342	14.48	12.08	33.95	39.49	1.16	5104	0.51	1.424	14.1	39.7	5968	0.60	1.00	6950	46.23	10570	subA
ML 8	/38 MLC 028	243.00	243.05	0.05	1.617	8.94	41.66	25.99	23.41	0.90	3157	0.73	1.721	45.8	28.5	3467	0.80	2.31	6391	52.61	10340	subB
ML 8	/38 MLC 029	243.50	243.55	0.05	1.585	9.09	41.43	23.67	25.81	1.09	3082	0.44	1.683	45.6	26.0	3390	0.48	1.43	6229	47.84	10044	subB
ML 8	/38 MLC 030	244.00	244.05	0.05	1.353	11.71	21.75	31.31	35.23	1.13	4386	0.72	1.419	24.6	35.5	4968	0.82	1.64	6592	47.05	10325	subB
ML 8	/38 MLC 031	244.50	244.55	0.05	1.532	10.15	28.68	29.73	31.44	1.06	3771	2.74	1.630	31.9	33.1	4197	3.05	7.27	6165	48.60	9850	subB
ML 8	/38 MLC 032	245.00	245.05	0.05	1.496	11.48	23.57	29.97	34.98	1.17	4181	1.12	1.599	26.6	33.9	4723	1.27	2.68	6437	46.14	10104	subB
ML 8	/38 MLC 033	245.50	245.55	0.05	1.527	10.28	33.91	26.29	29.52	1.12	3505	0.42	1.625	37.8	29.3	3907	0.47	1.20	6280	47.11	9958	subB
ML 8	/38 MLC 034	246.00	246.05	0.05	1.577	11.15	31.83	26.95	30.07	1.12	3673	0.50	1.700	35.8	30.3	4134	0.56	1.36	6442	47.26	10079	subB
ML 8	/38 MLC 035	246.50	246.55	0.05	1.496	10.81	29.61	28.52	31.06	1.09	3861	0.60	1.592	33.2	32.0	4329	0.67	1.55	6480	47.87	10223	subB
ML 8	/38 MLC 036	246.95	247.00	0.05	1.680	9.56	38.90	27.02	24.52	0.91	3343	1.98	1.810	43.0	29.9	3696	2.19	5.92	6486	52.43	10402	subB
ML 9	/38 MLC 037	218.70	218.75	0.05	1.605	10.45	53.42	26.73	9.40	0.35	1824	1.18	1.727	59.7	29.8	2037	1.32	6.47	5048	73.98	7740	ligA
ML 9	/38 MLC 038	219.25	219.30	0.05	1.411	13.63	35.53	27.10	23.74	0.88	3285	1.62	1.509	41.1	31.4	3803	1.88	4.93	6461	53.30	9602	subB
ML 9	/38 MLC 039	219.70	219.75	0.05	1.449	16.26	33.38	25.03	25.33	1.01	3221	2.19	1.587	39.9	29.9	3846	2.62	6.80	6396	49.70	9066	subC
ML 9	/38 MLC 040	220.30	220.35	0.05	1.627	11.28	45.75	23.05	19.92	0.86	2248	5.56	1.768	51.6	26.0	2534	6.27	24.73	5232	53.64	7928	ligA
ML 11	/38 MLC 041	95.10	95.15	0.05	1.987	7.59	67.97	16.83	7.61	0.45	1180	1.21	2.162	73.6	18.2	1277	1.31	10.25	4828	68.86	7959	ligA
ML 11	/38 MLC 043	99.00	99.05	0.05	1.416	15.64	23.31	30.95	30.10	0.97	3731	3.95	1.534	27.6	36.7	4423	4.68	10.59	6111	50.70	8972	subC
ML 11	/38 MLC 044	109.50	109.55	0.05	2.089	6.95	73.98	13.12	5.95	0.45	897	0.39	2.274	79.5	14.1	964	0.42	4.35	4704	68.80	8021	ligA
ML 11	/38 MLC 045	110.00	110.05	0.05	1.841	8.63	61.41	19.02	10.94	0.58	1641	2.29	2.000	67.2	20.8	1796	2.51	13.95	5477	63.48	8758	subC
ML 11	/38 MLC 046	115.90	115.95	0.05	2.030	7.42	69.24	14.24	9.10	0.64	1246	0.77	2.213	74.8	15.4	1346	0.83	6.18	5338	61.01	8889	subC
ML 11	/38 MLC 047	116.30	116.35	0.05	2.127	4.26	80.30	11.07	4.37	0.39	616	0.77	2.239	83.9	11.6	643	0.80	12.50	3990	71.70	8328	subC
ML 12	/38 MLC 048	126.90	126.95	0.05	1.584	13.90	47.04	23.90	15.16	0.63	2047	2.62	1.749	54.6	27.8	2377	3.04	12.80	5241	61.19	7441	ligA
ML 12	/38 MLC 049	135.10	135.15	0.05	1.562	12.54	48.32	24.02	15.12	0.63	2328	2.27	1.699	55.2	27.5	2662	2.60	9.75	5948	61.37	8755	subC
ML 12	/38 MLC 050	135.50	135.55	0.05	1.796	9.06	61.05	20.69	9.20	0.44	1390	4.17	1.951	67.1	22.8	1528	4.59	30.00	4650	69.22	7219	ligA
ML 12	/38 MLC 051	136.03	136.08	0.05	1.843	10.36	68.62	14.35	6.67	0.46	1009	0.58	2.042	76.6	16.0	1126	0.65	5.75	4800	68.27	6989	ligA
ML 12	/38 MLC 052	146.30	146.35	0.05	1.487	12.89	29.33	32.85	24.93	0.76	3399	5.34	1.602	33.7	37.7	3902	6.13	15.71	5883	56.85	8949	subC
ML 12	/38 MLC 053	146.90	146.95	0.05	1.632	10.07	54.89	23.18	11.86	0.51	1932	3.08	1.756	61.0	25.8	2148	3.42	15.94	5514	66.15	8517	subC
ML 12	/38 MLC 054	147.25	147.30	0.05	1.796	7.90	65.48	18.25	8.37	0.46	1238	2.61	1.928	71.1	19.8	1344	2.83	21.08	4651	68.56	7534	ligA
ML 12	/38 MLC 056	158.15	158.20	0.05	1.530	16.09	37.39	27.54	18.98	0.69	2659	3.53	1.703	44.6	32.8	3169	4.21	13.28	5716	59.20	7992	ligA
ML 12	/38 MLC 057	158.65	158.70	0.05	1.553	14.34	38.23	27.21	20.22	0.74	2686	5.17	1.711	44.6	31.8	3136	6.04	19.25	5663	57.37	8191	ligA
ML 12	/38 MLC 058	161.30	161.35	0.05	1.529	16.66	37.25	26.85	19.24	0.72	2907	3.43	1.710	44.7	32.2	3488	4.12	11.80	6307	58.26	8744	subC
ML 12	/38 MLC 059	171.50	171.55	0.05	1.679	15.40	33.57	28.02	23.01	0.82	2332	9.62	1.916	39.7	33.1	2757	11.37	41.25	4570	54.91	6358	ligA
ML 12	/38 MLC 060	179.20	179.25	0.05	1.607	11.46	45.72	26.05	16.77	0.64	2273	4.48	1.744	51.6	29.4	2567	5.06	19.71	5308	60.84	8031	ligA
ML 12	/38 MLC 061	180.00	180.05	0.05	1.559	13.59	31.20	30.57	24.64	0.81	3040	5.01	1.709	36.1	35.4	3518	5.80	16.48	5506	55.37	8217	ligA
ML 13	/38 MLC 062	196.00	196.05	0.05	1.445	16.15	37.16	22.62	24.07	1.06	3018	0.54	1.580	44.3	27.0	3599	0.64	1.79	6464	48.45	9074	subC
ML 13	/38 MLC 063	196.60	196.65	0.05	1.436	18.21	29.80	25.04	26.95	1.08	3490	0.87	1.590	36.4	30.6	4267	1.06	2.49	6713	48.16	9265	subC
ML 13	/38 MLC 064	198.55	198.60	0.05	1.614	11.57	53.42	18.74	16.27	0.87	2212	0.59	1.755	60.4	21.2	2501	0.67	2.67	6318	53.53	9414	subC
ML 13	/38 MLC 065	214.75	214.85	0.10	1.393	14.38	21.70	30.60	33.32	1.09	4271	2.10	1.491	25.3	35.7	4988	2.45	4.92	6682	47.87	10056	subB
ML 13	/38 MLC 066	215.10	215.20	0.10	1.405	15.72	20.59	29.52	34.17	1.16	4260	0.81	1.520	24.4	35.0	5055	0.96	1.90	6689	46.35	9865	subB
ML 13	/38 MLC 067	215.60	215.70	0.10	1.720	7.88	54.28	22.13	15.71	0.71	2096	2.26	1.833	58.9	24.0	2275	2.45	10.78	5539	58.48	9119	subC
ML 13	/38 MLC 068	216.10	216.20	0.10	1.696	9.06	51.32	21.87	17.75	0.81	2442	1.26	1.822	56.4	24.0	2685	1.39	5.16	6164	55.20	9873	subB

hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML 13	/38 MLC 069	217.60	217.70	0.10	1.397	15.73	27.30	34.63	22.34	0.65	3581	1.36	1.509	32.4	41.1	4249	1.61	3.80	6286	60.79	9141	subC
ML 13	/38 MLC 070	218.00	218.05	0.05	1.505	13.65	30.35	29.93	26.07	0.87	3067	6.42	1.636	35.1	34.7	3552	7.43	20.93	5477	53.45	8164	ligA
ML 13	/38 MLC 071	218.60	218.70	0.10	1.375	18.60	21.72	28.12	31.56	1.12	4049	1.08	1.504	26.7	34.5	4974	1.33	2.67	6785	47.12	9525	subB
ML 15	/38 MLC 072	127.65	127.70	0.05	1.687	12.14	50.64	23.07	14.15	0.61	1882	3.65	1.864	57.6	26.3	2142	4.15	19.39	5056	61.98	7402	ligA
ML 15	/38 MLC 073	128.15	128.20	0.05	1.584	10.84	50.78	22.13	16.25	0.73	2430	1.03	1.705	57.0	24.8	2725	1.16	4.24	6331	57.66	9694	subB
ML 15	/38 MLC 074	128.80	128.85	0.05	1.432	17.72	29.23	25.11	27.94	1.11	3466	0.80	1.579	35.5	30.5	4212	0.97	2.31	6533	47.33	9117	subC
ML 15	/38 MLC 075	129.25	129.30	0.05	1.477	11.26	40.11	25.80	22.83	0.88	2970	1.94	1.572	45.2	29.1	3347	2.19	6.53	6107	53.05	9438	subC
ML 15	/38 MLC 076	129.75	129.80	0.05	1.517	12.11	36.63	27.85	23.41	0.84	3042	3.37	1.633	41.7	31.7	3461	3.83	11.08	5934	54.33	9059	subC
ML 15	/38 MLC 077	130.20	130.25	0.05	1.638	13.19	51.38	21.16	14.27	0.67	2037	1.65	1.814	59.2	24.4	2347	1.90	8.10	5749	59.72	8220	ligA
ML 15	/38 MLC 078	130.65	130.70	0.05	1.371	16.22	26.13	29.74	27.91	0.94	3709	2.48	1.477	31.2	35.5	4427	2.96	6.69	6434	51.59	9305	subC
ML 15	/38 MLC 079	131.10	131.15	0.05	1.359	22.13	9.01	31.56	37.30	1.18	4737	0.92	1.513	11.6	40.5	6083	1.18	1.94	6879	45.83	9448	subC
ML 15	/38 MLC 080	131.65	131.70	0.05	1.626	12.21	46.84	22.25	18.70	0.84	2527	0.91	1.781	53.4	25.3	2878	1.04	3.60	6171	54.33	9206	subC
ML 15	/38 MLC 081	132.20	132.25	0.05	1.618	16.03	41.49	21.58	20.90	0.97	2655	1.14	1.834	49.4	25.7	3162	1.36	4.29	6250	50.80	8654	subC
ML 15	/38 MLC 082	132.85	132.90	0.05	1.724	12.67	56.50	18.75	12.08	0.64	1786	2.10	1.926	64.7	21.5	2045	2.40	11.76	5793	60.82	8222	ligA
ML 15	/38 MLC 083	133.40	133.45	0.05	1.818	11.07	57.25	20.26	11.42	0.56	1670	3.64	2.024	64.4	22.8	1878	4.09	21.80	5271	63.95	7808	ligA
ML 15	/38 MLC 084	134.25	134.30	0.05	1.639	11.64	40.34	26.52	21.50	0.81	2501	7.70	1.790	45.7	30.0	2830	8.71	30.79	5208	55.23	7887	ligA
ML 16	/38 MLC 085	174.60	174.70	0.10	1.382	17.17	25.11	29.29	28.43	0.97	3864	1.41	1.501	30.3	35.4	4665	1.70	3.65	6694	50.74	9548	subB
ML 16	/38 MLC 086	175.10	175.20	0.10	1.400	15.70	26.48	29.09	28.73	0.99	3659	1.49	1.513	31.4	34.5	4340	1.77	4.07	6328	50.31	9226	subC
ML 16	/38 MLC 087	175.55	175.65	0.10	1.453	19.34	29.55	24.73	26.38	1.07	3410	1.03	1.630	36.6	30.7	4228	1.28	3.02	6672	48.39	9014	subC
ML 16	/38 MLC 088	176.00	176.10	0.10	1.544	18.10	43.98	19.11	18.81	0.98	2482	0.83	1.755	53.7	23.3	3031	1.01	3.34	6545	50.40	8504	subC
ML 16	/38 MLC 089	176.40	176.45	0.05	1.554	19.24	39.73	19.54	21.49	1.10	2698	0.54	1.790	49.2	24.2	3341	0.67	2.00	6576	47.62	8503	subC
ML 16	/38 MLC 090	176.75	176.80	0.05	1.900	6.77	68.63	15.60	9.00	0.58	1212	1.03	2.033	73.6	16.7	1300	1.10	8.50	4927	63.41	8415	subC
ML 16	/38 MLC 091	177.25	177.30	0.05	1.855	10.03	61.91	17.55	10.51	0.60	1563	0.63	2.050	68.8	19.5	1737	0.70	4.03	5570	62.54	8484	subC
ML 16	/38 MLC 092	177.90	177.95	0.05	1.570	12.12	42.00	23.37	22.51	0.96	2805	1.21	1.704	47.8	26.6	3192	1.38	4.31	6114	50.94	9242	subC
ML 16	/38 MLC 093	178.86	178.93	0.07	1.549	13.60	22.06	37.52	26.82	0.71	3916	3.49	1.696	25.5	43.4	4532	4.04	8.91	6086	58.32	9258	subC
ML 16	/38 MLC 094	179.28	179.35	0.07	1.448	15.07	21.16	32.92	30.85	0.94	3587	5.42	1.573	24.9	38.8	4223	6.38	15.11	5625	51.62	8340	subC
ML 16	/38 MLC 095	179.83	179.90	0.07	1.755	8.50	58.32	20.39	12.79	0.63	1683	1.82	1.887	63.7	22.3	1839	1.99	10.81	5072	61.45	8159	ligA
ML 16	/38 MLC 096	180.43	180.50	0.07	1.568	9.61	45.08	25.65	19.66	0.77	2722	1.57	1.669	49.9	28.4	3011	1.74	5.77	6008	56.61	9556	subB
ML 16	/38 MLC 097	180.93	181.00	0.07	1.456	11.81	26.12	33.71	28.36	0.84	3198	3.46	1.551	29.6	38.2	3626	3.92	10.82	5152	54.31	7989	ligA
ML 16	/38 MLC 098	181.30	181.37	0.07	1.645	9.68	47.58	21.75	20.99	0.97	2317	3.48	1.767	52.7	24.1	2565	3.85	15.02	5421	50.89	8558	subC
ML 16	/38 MLC 099	181.78	181.85	0.07	1.717	7.85	57.11	22.51	12.53	0.56	1561	3.47	1.829	62.0	24.4	1694	3.77	22.23	4455	64.24	7240	ligA
ML 16	/38 MLC 100	182.43	182.50	0.07	1.572	10.19	45.44	25.32	19.05	0.75	2283	4.75	1.681	50.6	28.2	2542	5.29	20.81	5145	57.07	8014	ligA
ML 16	/38 MLC 101	182.85	182.90	0.05	1.513	11.44	45.78	23.98	18.80	0.78	2594	1.15	1.620	51.7	27.1	2929	1.30	4.43	6064	56.05	9237	subC
ML 16	/38 MLC 102	183.15	183.23	0.08	1.355	18.28	18.71	31.53	31.48	1.00	3764	3.42	1.472	22.9	38.6	4606	4.19	9.09	5974	50.04	8476	subC
ML 16	/38 MLC 103	183.60	183.65	0.05	1.774	7.66	59.77	20.70	11.87	0.57	1596	2.36	1.896	64.7	22.4	1728	2.56	14.79	4900	63.56	8067	ligA
ML 16	/38 MLC 105	184.45	184.53	0.08	1.802	7.95	54.55	23.18	14.32	0.62	1587	5.87	1.936	59.3	25.2	1724	6.38	36.99	4232	61.81	6770	ligA
ML 16	/38 MLC 106	184.95	185.05	0.10	1.551	8.89	47.63	25.61	17.87	0.70	2268	5.07	1.639	52.3	28.1	2489	5.56	22.35	5216	58.90	8365	subC
ML 16	/38 MLC 107	185.50	185.57	0.07	1.288	17.14	9.89	34.95	38.02	1.09	4992	1.51	1.370	11.9	42.2	6025	1.82	3.02	6841	47.90	10069	subB
ML 16	/38 MLC 108	194.45	194.50	0.05	1.643	10.00	46.92	25.95	17.13	0.66	2452	2.23	1.769	52.1	28.8	2724	2.48	9.09	5692	60.24	8944	subC
ML 16	/38 MLC 109	194.80	194.85	0.05	1.302	19.14	5.62	31.77	43.47	1.37	4902	1.30	1.402	7.0	39.3	6062	1.61	2.65	6515	42.22	9396	subC
ML 17	/38 MLC 110	59.65	59.70	0.05	1.611	12.07	48.10	24.10	15.73	0.65	1985	4.12	1.758	54.7	27.4	2257	4.69	20.76	4984	60.51	7354	ligA
ML 19	/38 MLC 111	94.53	94.60	0.07	1.411	16.15	38.64	24.96	20.25	0.81	2937	1.43	1.532	46.1	29.8	3503	1.71	4.87	6496	55.21	9073	subC
ML 19	/38 MLC 112	94.97	95.03	0.06	1.706	10.59	64.98	15.38	9.05	0.59	1245	0.34	1.862	72.7	17.2	1392	0.38	2.73	5096	62.96	7505	ligA
ML 19	/38 MLC 113	95.35	95.43	0.08	1.556	12.38	48.12	21.81	17.69	0.81	2436	0.53	1.689	54.9	24.9	2780	0.60	2.18	6167	55.22	9129	subC

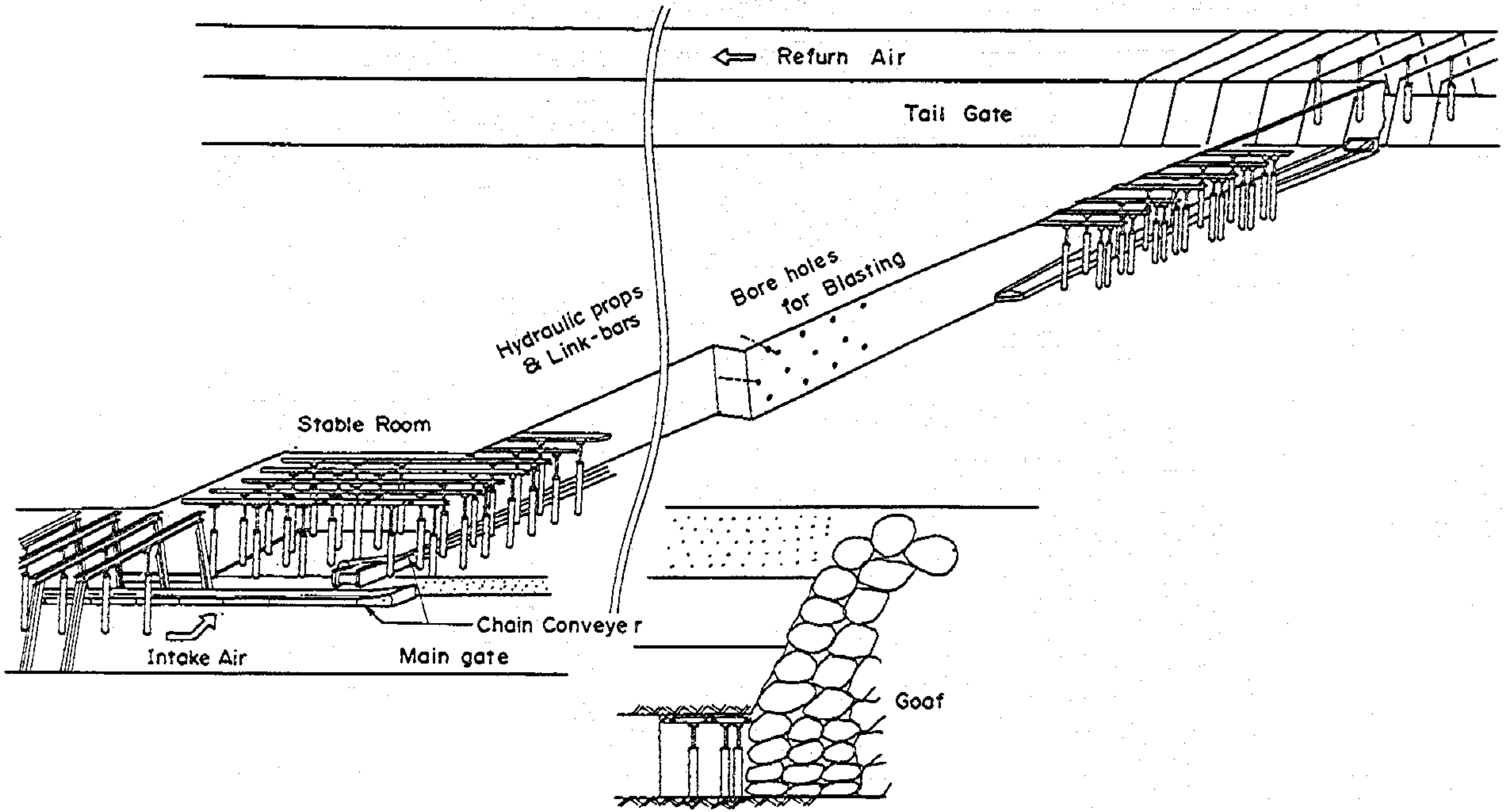
hole No.	sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML 19	/38 MLC 114	95.93	96.00	0.07	1.697	11.52	57.18	19.34	11.96	0.62	1681	2.26	1.866	64.6	21.9	1900	2.55	13.44	5371	61.79	7872	ligA
ML 19	/38 MLC 116	96.95	97.00	0.05	1.264	20.98	7.51	35.71	35.80	1.00	5005	1.31	1.359	9.5	45.2	6334	1.66	2.62	6999	49.94	9810	subB
ML 19	/38 MLC 117	97.43	97.50	0.07	1.430	21.66	25.00	23.64	29.70	1.26	3544	0.76	1.623	31.9	30.2	4524	0.97	2.14	6644	44.32	8737	subC
ML 19	/38 MLC 118	98.00	98.07	0.07	1.484	18.40	30.52	22.99	28.09	1.22	3310	1.69	1.666	37.4	28.2	4056	2.07	5.11	6480	45.01	8885	subC
ML 19	/38 MLC 119	98.43	98.50	0.07	1.357	20.63	12.83	32.10	34.44	1.07	4381	3.03	1.496	16.2	40.4	5520	3.82	6.92	6584	48.24	9155	subC
ML 19	/38 MLC 120	99.00	99.07	0.07	1.534	15.58	39.60	24.22	20.60	0.85	2766	2.35	1.702	46.9	28.7	3276	2.78	8.50	6171	54.04	8690	subC
ML 19	/38 MLC 121	99.40	99.47	0.07	1.495	17.33	30.42	27.11	25.14	0.93	3069	7.49	1.668	36.8	32.8	3712	9.06	24.41	5874	51.89	8171	ligA
ML 19	/38 MLC 122	99.87	99.95	0.08	1.555	14.70	31.87	28.72	24.71	0.86	2586	7.24	1.719	37.4	33.7	3032	8.49	28.00	4840	53.75	6969	ligA
ML 19	/38 MLC 123	100.50	100.57	0.07	1.571	12.23	31.72	29.00	27.05	0.93	3012	7.99	1.707	36.1	33.0	3432	9.10	26.53	5374	51.74	8186	ligA
ML 19	/38 MLC 124	101.00	101.07	0.07	1.426	15.19	20.83	31.22	32.76	1.05	3757	5.92	1.544	24.6	36.8	4430	6.98	15.76	5872	48.80	8710	subC
ML 19	/38 MLC 125	101.40	101.47	0.07	1.264	19.84	3.84	37.26	39.06	1.05	5506	1.89	1.352	4.8	46.5	6869	2.36	3.43	7214	48.82	10353	subB
ML 20	/38 MLC 126	95.43	95.50	0.07	1.627	16.08	52.08	17.63	14.21	0.81	2002	0.90	1.849	62.1	21.0	2386	1.07	4.50	6288	55.37	8226	ligA
ML 20	/38 MLC 127	95.93	96.00	0.07	1.340	17.29	13.70	32.20	36.81	1.14	4693	0.98	1.443	16.6	38.9	5674	1.18	2.09	6800	46.66	9920	subB
ML 21	/38 MLC 128	200.15	200.20	0.05	1.801	9.31	51.12	21.98	17.59	0.80	2185	3.42	1.962	56.4	24.2	2409	3.77	15.65	5522	55.55	8767	subC
ML 21	/38 MLC 129	200.65	200.73	0.08	1.300	18.42	4.84	33.83	42.91	1.27	5311	0.78	1.394	5.9	41.5	6510	0.96	1.47	6921	44.08	10092	subB
ML 21	/38 MLC 130	201.00	201.07	0.07	1.491	15.58	38.51	23.90	22.01	0.92	2666	1.87	1.640	45.6	28.3	3158	2.22	7.01	5807	52.06	8200	ligA
ML 21	/38 MLC 131	201.50	201.57	0.07	1.489	15.20	42.78	22.75	19.27	0.85	2565	1.86	1.632	50.4	26.8	3025	2.19	7.25	6104	54.14	8572	subC
ML 21	/38 MLC 132	201.93	202.00	0.07	1.447	14.22	32.97	26.11	26.70	1.02	3298	2.03	1.563	38.4	30.4	3845	2.37	6.16	6245	49.44	9221	subC
ML 21	/38 MLC 133	202.50	202.57	0.07	1.716	9.48	57.91	18.99	13.62	0.72	1736	1.25	1.855	64.0	21.0	1918	1.38	7.20	5324	58.23	8328	subC
ML 21	/38 MLC 134	203.30	203.37	0.07	1.704	9.80	50.89	21.57	17.74	0.82	2252	2.07	1.845	56.4	23.9	2497	2.29	9.19	5729	54.87	8998	subC
ML 21	/38 MLC 135	203.65	203.70	0.05	1.750	7.97	54.54	21.60	15.89	0.74	1800	4.51	1.872	59.3	23.5	1956	4.90	25.06	4801	57.62	7806	ligA
ML 21	/38 MLC 136	204.30	204.37	0.07	1.542	13.70	34.18	37.59	14.53	0.39	3250	3.97	1.687	39.6	43.6	3766	4.60	12.22	6236	72.12	9280	subC
ML 21	/38 MLC 137	204.83	204.90	0.07	1.430	13.83	23.26	31.18	31.73	1.02	3829	3.69	1.536	27.0	36.2	4444	4.28	9.64	6086	49.56	9208	subC
ML 21	/38 MLC 138	205.40	205.47	0.07	1.709	10.57	57.23	19.35	12.85	0.66	1659	2.37	1.865	64.0	21.6	1855	2.65	14.29	5152	60.09	7774	ligA
ML 21	/38 MLC 139	205.83	205.90	0.07	1.368	14.74	24.50	29.32	31.44	1.07	3736	2.18	1.461	28.7	34.4	4382	2.56	5.84	6149	48.26	9145	subC
ML 21	/38 MLC 140	206.33	206.40	0.07	1.622	10.08	51.68	22.08	16.16	0.73	2416	0.67	1.744	57.5	24.6	2687	0.75	2.77	6318	57.74	9848	subB
ML 21	/38 MLC 141	206.78	206.85	0.07	1.556	11.99	40.12	26.40	21.49	0.81	2830	2.06	1.684	45.6	30.0	3216	2.34	7.28	5909	55.13	8987	subC
ML 21	/38 MLC 142	207.28	207.35	0.07	1.305	18.67	6.65	34.11	40.57	1.19	4830	1.68	1.403	8.2	41.9	5939	2.07	3.48	6468	45.67	9369	subC
ML 21	/38 MLC 143	207.83	207.90	0.07	1.572	12.30	40.30	26.56	20.84	0.78	2588	4.76	1.709	46.0	30.3	2951	5.43	18.39	5460	56.03	8208	ligA
ML 21	/38 MLC 144	208.35	208.42	0.07	1.693	10.21	37.96	28.08	23.75	0.85	2611	9.08	1.838	42.3	31.3	2908	10.11	34.78	5038	54.18	7861	ligA
ML 21	/38 MLC 145	208.93	209.00	0.07	1.606	12.01	46.38	22.74	18.87	0.83	2158	4.82	1.751	52.7	25.8	2453	5.48	22.34	5186	54.65	7709	ligA
ML 21	/38 MLC 146	209.40	209.47	0.07	1.382	15.06	13.54	35.42	35.98	1.02	4146	4.74	1.482	15.9	41.7	4881	5.58	11.43	5807	49.61	8730	subC
ML 21	/38 MLC 147	210.10	210.17	0.07	1.568	11.34	40.07	25.56	23.03	0.90	2583	6.43	1.691	45.2	28.8	2913	7.25	24.89	5316	52.60	8137	ligA
ML 21	/38 MLC 148	210.53	210.60	0.07	1.627	9.23	54.78	22.02	13.97	0.63	2126	1.69	1.738	60.4	24.3	2342	1.86	7.95	5907	61.18	9377	subC
ML 21	/38 MLC 149	211.30	211.37	0.07	1.662	9.19	51.65	21.67	17.49	0.81	1983	3.21	1.781	56.9	23.9	2184	3.53	16.19	5064	55.34	8030	ligA
ML 21	/38 MLC 150	211.83	211.90	0.07	1.671	6.83	65.29	18.18	9.70	0.53	1588	0.51	1.757	70.1	19.5	1704	0.55	3.21	5696	65.21	9700	subB
ML 21	/38 MLC 151	212.55	212.60	0.05	1.565	13.87	46.08	21.81	18.24	0.84	2334	1.97	1.722	53.5	25.3	2710	2.29	8.44	5828	54.46	8347	subC
ML 21	/38 MLC 152	212.95	213.00	0.05	1.734	11.90	48.43	22.40	17.27	0.77	1804	8.18	1.925	55.0	25.4	2048	9.28	45.34	4548	56.47	6570	ligA
ML 21	/38 MLC 153	213.50	213.57	0.07	1.542	12.36	46.21	22.15	19.28	0.87	1920	6.53	1.670	52.7	25.3	2191	7.45	34.01	4634	53.46	6730	ligA
ML 21	/38 MLC 155	214.40	214.45	0.05	1.559	12.49	43.73	26.43	17.35	0.66	2772	1.90	1.694	50.0	30.2	3168	2.17	6.85	6332	60.37	9462	subC
ML 21	/38 MLC 156	214.90	214.95	0.05	1.540	12.79	39.92	25.87	21.42	0.83	2874	4.33	1.672	45.8	29.7	3295	4.97	15.07	6077	54.71	9094	subC
ML 21	/38 MLC 157	220.70	220.75	0.05	1.629	10.97	47.86	23.11	18.06	0.78	2476	2.18	1.766	53.8	26.0	2781	2.45	8.80	6014	56.13	9229	subC
ML 21	/38 MLC 158	222.93	223.00	0.07	1.570	13.64	35.82	27.30	23.24	0.85	2791	5.74	1.725	41.5	31.6	3232	6.65	20.57	5522	54.02	8145	ligA
ML 21	/38 MLC 159	outcrop		####	1.426	12.77	10.74	35.61	40.88	1.15	4573	1.48	1.521	12.3	40.8	5242	1.70	3.24	5979	46.56	9314	subC

hole No.		sample No.	analytical sample from	to	thick	as analysed basis SpGr	M	ASH	VM	FC	(FR)	CV	TS	dry basis SpGr	ASH	VM	CV	TS	TSmg/kcal	dry ash free basis CV	VM	ASTM class Btu/lb	Class
ML	21	/38 MLC 160	outcrop		####	1.408	13.78	9.92	35.92	40.38	1.12	4716	1.20	1.506	11.5	41.7	5470	1.39	2.54	6181	47.08	9510	subB
MLG	1	/39 MLG 001	305.20	310.00	4.80	1.454	18.60	22.40	27.00	32.00	1.19	3954	2.34	1.622	27.5	33.2	4857	2.87	5.92	6702	45.76	9394	subC
MLG	1	/39 MLG 002	310.76	311.00	0.24	1.660	14.67	47.99	21.08	16.26	0.77	2269	1.89	1.872	56.2	24.7	2659	2.21	8.33	6077	56.45	8465	subC
MLG	1	/39 MLG 003	320.93	323.13	2.20	1.849	11.92	56.06	18.07	13.95	0.77	1865	1.10	2.089	63.6	20.5	2117	1.25	5.90	5824	56.43	8499	subC
MLG	2	/39 MLG 004	142.24	143.25	1.01	1.579	14.95	34.53	24.53	25.99	1.06	3167	4.01	1.758	40.6	28.8	3724	4.71	12.66	6269	48.56	9091	subC
MLG	2	/39 MLG 005	144.00	144.22	0.22	1.354	22.98	14.46	27.55	35.01	1.27	4413	0.95	1.514	18.8	35.8	5730	1.23	2.15	7054	44.04	9415	subC
MLG	2	/39 MLG 006	144.65	149.05	4.40	1.478	17.88	36.18	23.94	22.00	0.92	3074	0.95	1.650	44.1	29.2	3743	1.16	3.09	6691	52.11	9082	subC
MLG	2	/39 MLG 007	154.70	155.20	0.50	1.497	16.63	30.92	26.79	25.66	0.96	3459	3.89	1.662	37.1	32.1	4149	4.67	11.25	6595	51.08	9356	subC
MLG	3	/39 MLG 008	134.50	135.02	0.52	1.416	23.94	21.77	28.72	25.57	0.89	3449	3.47	1.629	28.6	37.8	4535	4.56	10.06	6353	52.90	8092	ligA
MLG	3	/39 MLG 009	145.74	148.40	2.66	1.879	15.14	59.96	17.24	7.66	0.44	1347	2.14	2.228	70.7	20.3	1587	2.52	15.89	5410	69.24	6803	ligA
MLG	3	/39 MLG 010	150.40	151.05	0.65	1.862	13.80	61.76	16.89	7.55	0.45	1408	1.27	2.160	71.6	19.5	1633	1.47	9.02	5761	69.11	7579	ligA
MLG	3	/39 MLG 011	154.50	155.50	1.00	1.732	16.69	52.88	19.14	11.29	0.59	1836	0.84	2.030	63.5	23.0	2204	1.01	4.58	6034	62.90	7690	ligA
MLG	4	/39 MLG 012	230.54	232.03	1.49	1.616	15.77	42.89	22.57	18.77	0.83	2694	0.84	1.827	50.9	26.8	3198	1.00	3.12	6517	54.60	9033	subC
MLG	4	/39 MLG 013	250.20	253.05	2.85	1.666	15.14	44.70	22.27	17.89	0.80	2608	0.77	1.891	52.7	26.2	3073	0.91	2.95	6494	55.45	9076	subC
MLG	4	/39 MLG 014	254.80	258.30	3.50	1.585	13.90	41.65	24.40	20.05	0.82	2815	1.79	1.750	48.4	28.3	3269	2.08	6.36	6333	54.89	9212	subC
MLG	4	/39 MLG 015	258.65	259.20	0.55	1.815	12.30	60.70	18.43	8.57	0.47	1528	1.77	2.049	69.2	21.0	1742	2.02	11.58	5659	68.26	7953	ligA
MLG	4	/39 MLG 016	260.00	261.00	1.00	1.769	11.63	57.49	19.79	11.09	0.56	1839	1.02	1.968	65.1	22.4	2081	1.15	5.55	5955	64.09	3726	subC
MLG	4	/39 MLG 017	262.40	265.40	3.00	1.608	14.04	44.35	24.57	17.04	0.69	2541	2.14	1.785	51.6	28.6	2956	2.49	8.42	6107	59.05	8771	subC
MLG	4	/39 MLG 018	279.40	279.90	0.50	1.630	12.31	48.03	22.41	17.25	0.77	2362	3.47	1.788	54.8	25.6	2694	3.96	14.69	5956	56.51	8823	subC

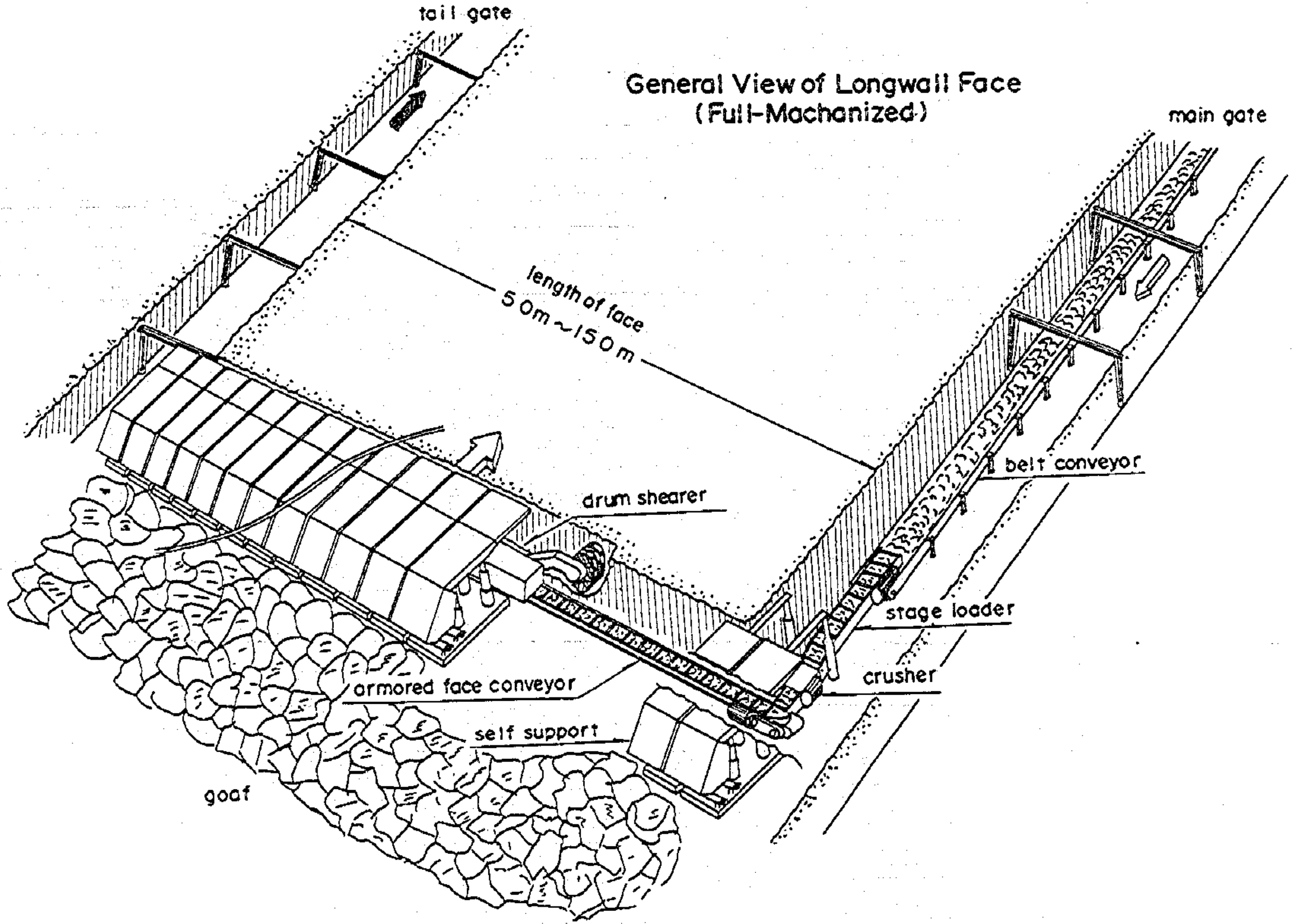
Appendix 2. Illustrations of Semi-mechanized Mining System

Appendix 2 Semi-mechanized Mining System

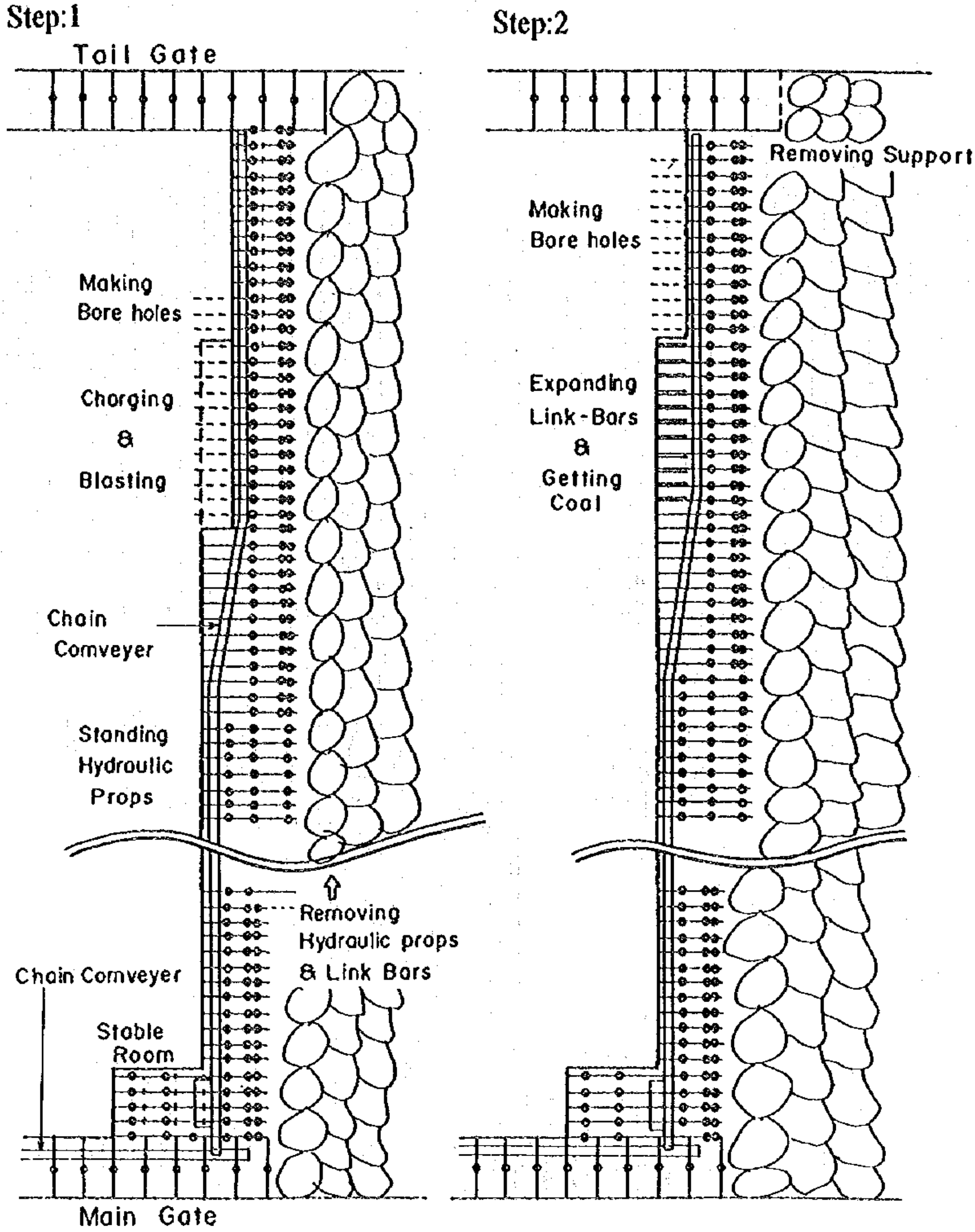
General View of Longwall Face
(Semi-Mechanized)



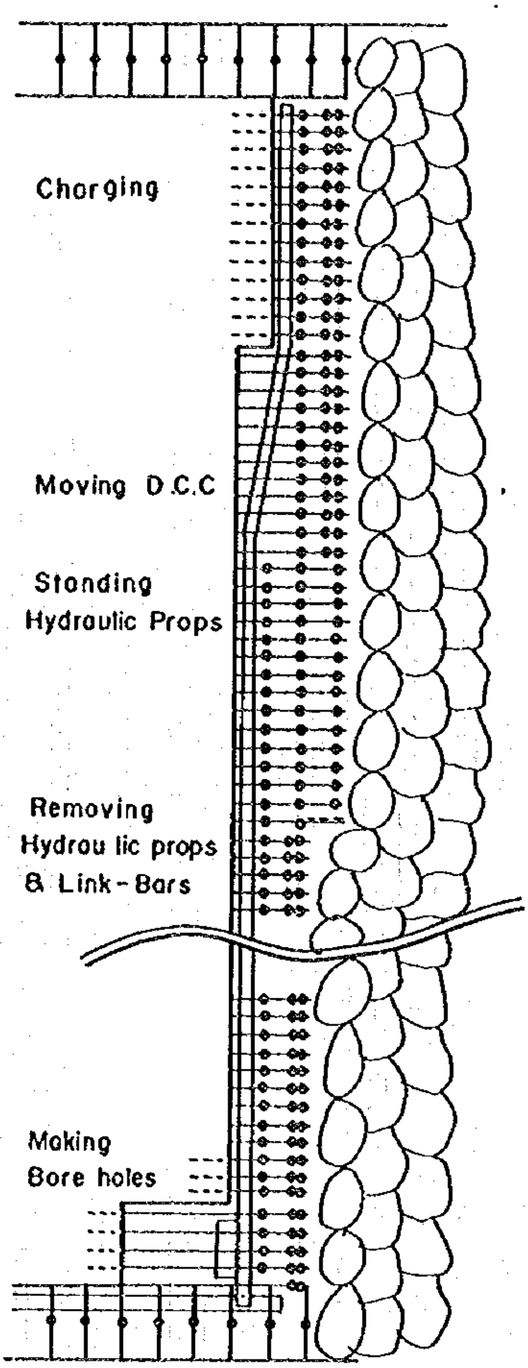
General View of Longwall Face
(Full-Machanized)



Lay Out of Longwall and Sequence of work

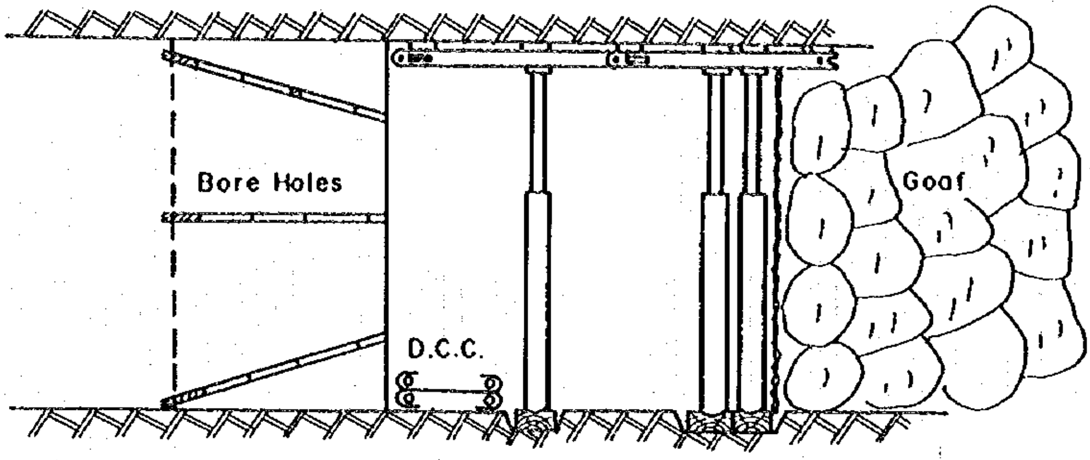


Step:3

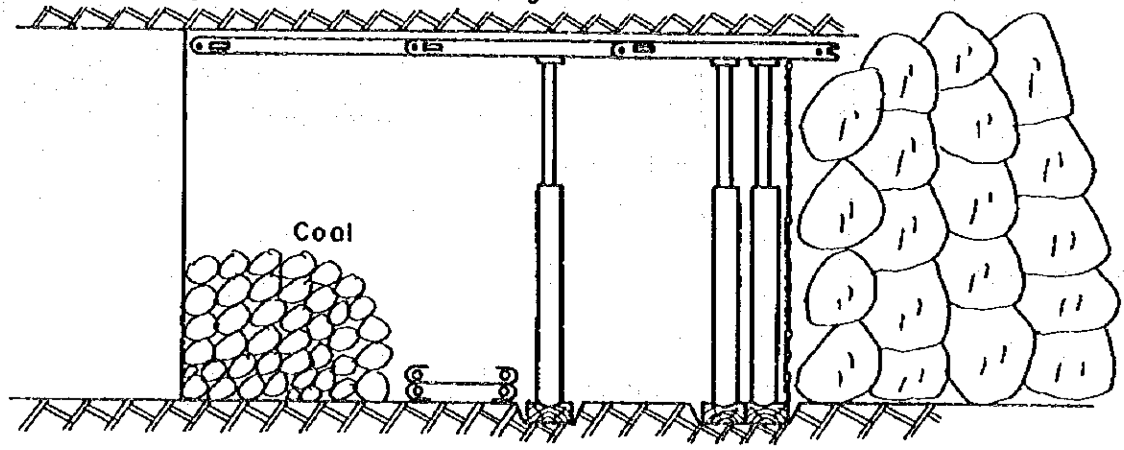

Chorging
Moving D.C.C
Stonding
Hydroulic Props
Removing
Hydrou lic props
& Link-Bars
Moking
Bore holes

Sequence of Work
(Cross Section)

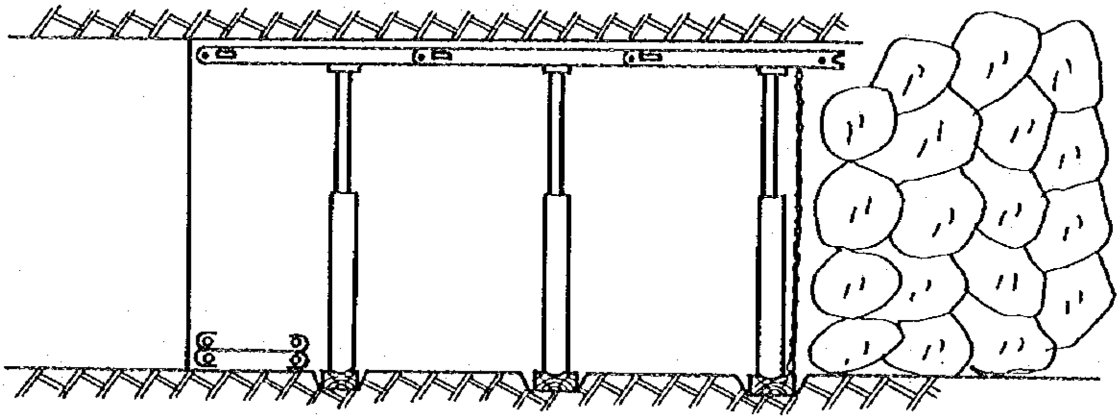
① Before Getting Coal



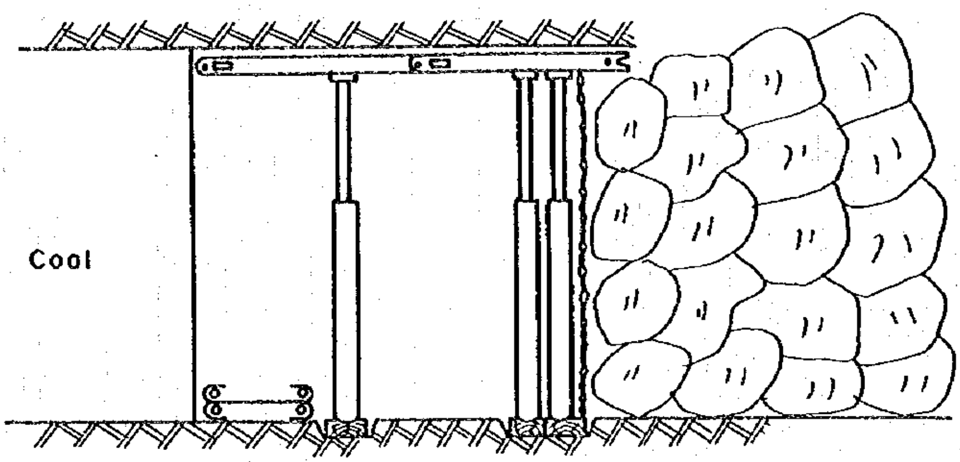
② Expanding Link-Bars & Getting Coal



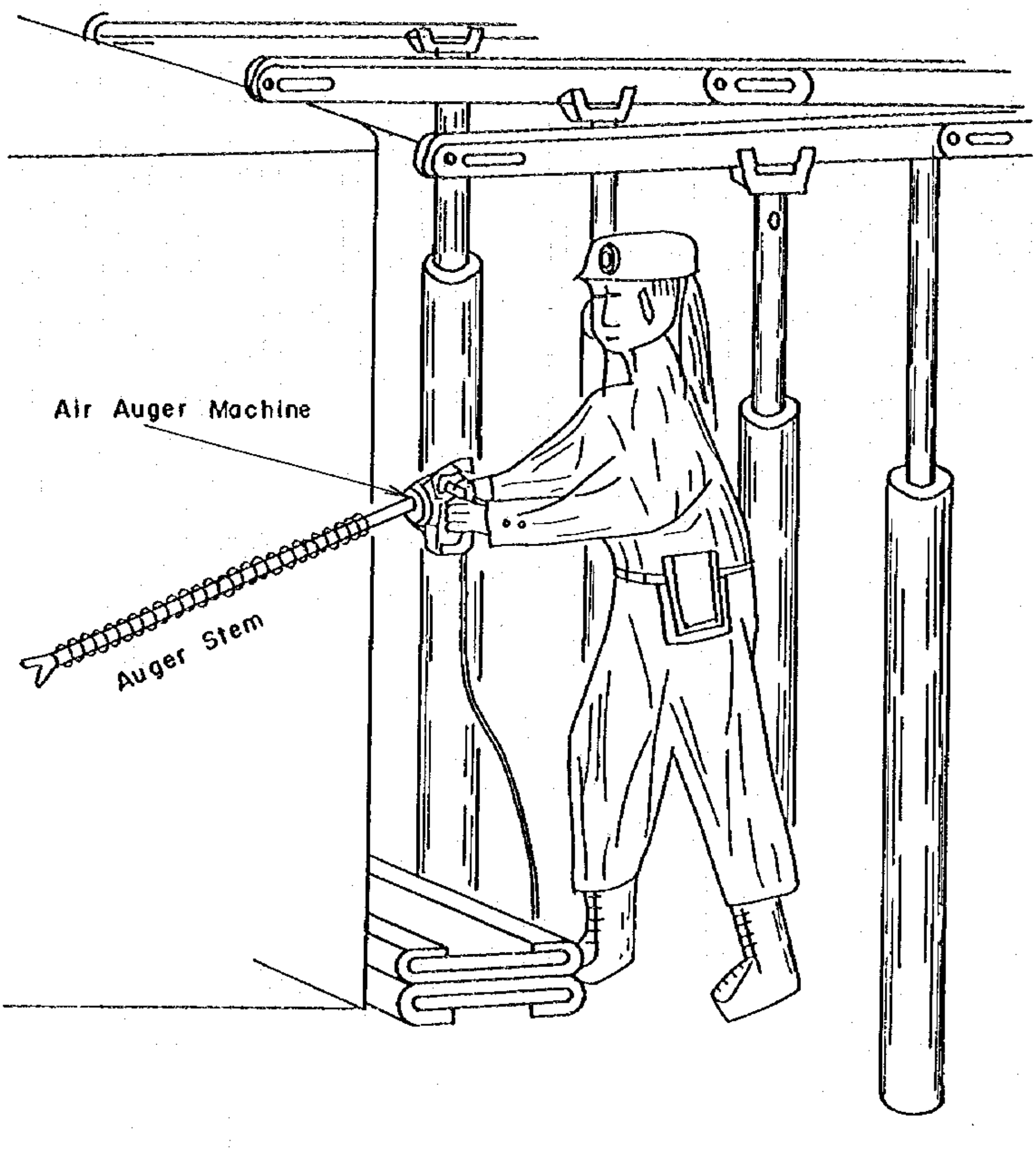
③ Moving D.C.Conveyor & Standing Hydraulic-Props



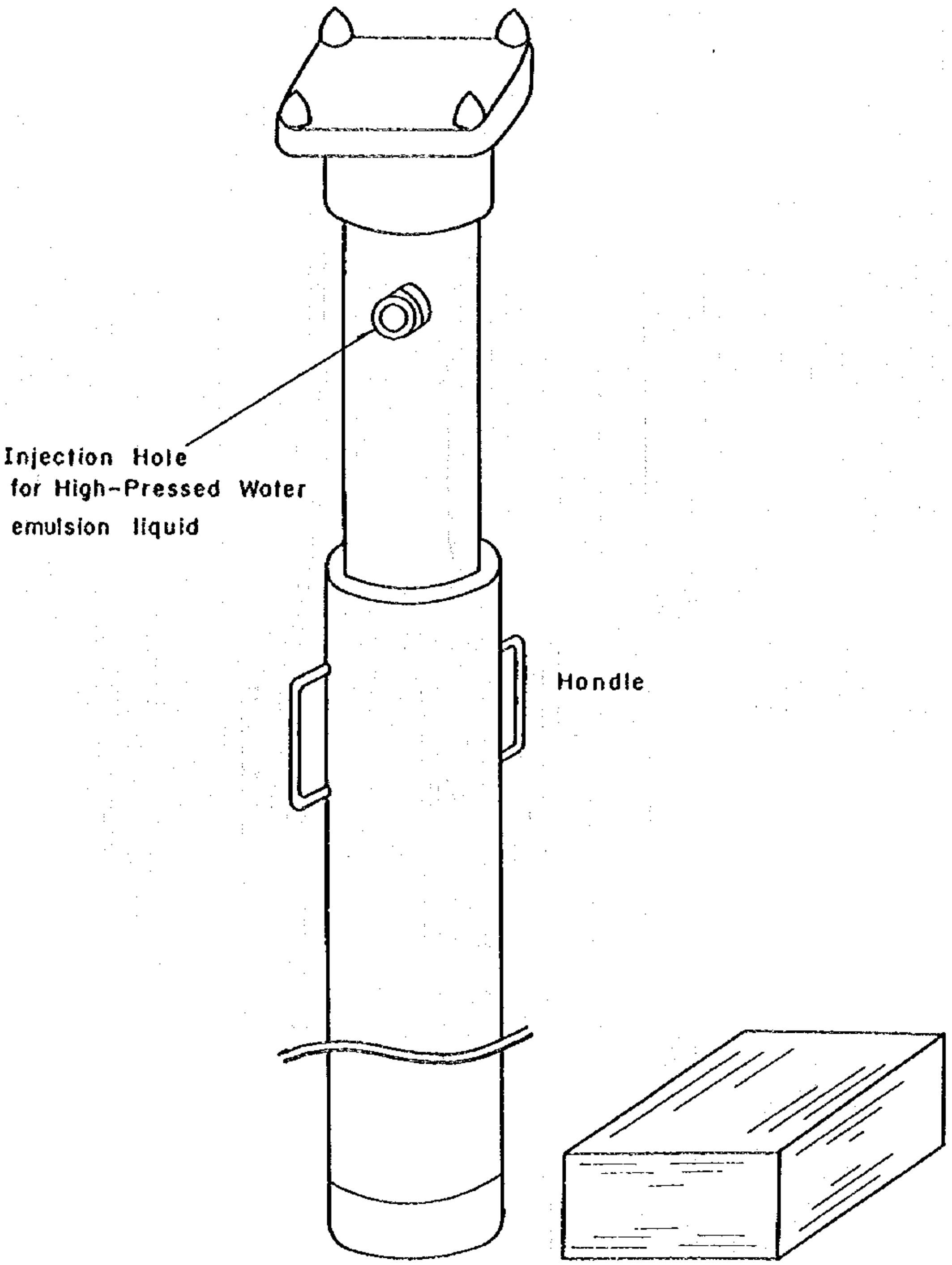
④ Removing Hydraulic Props & Link - Bars



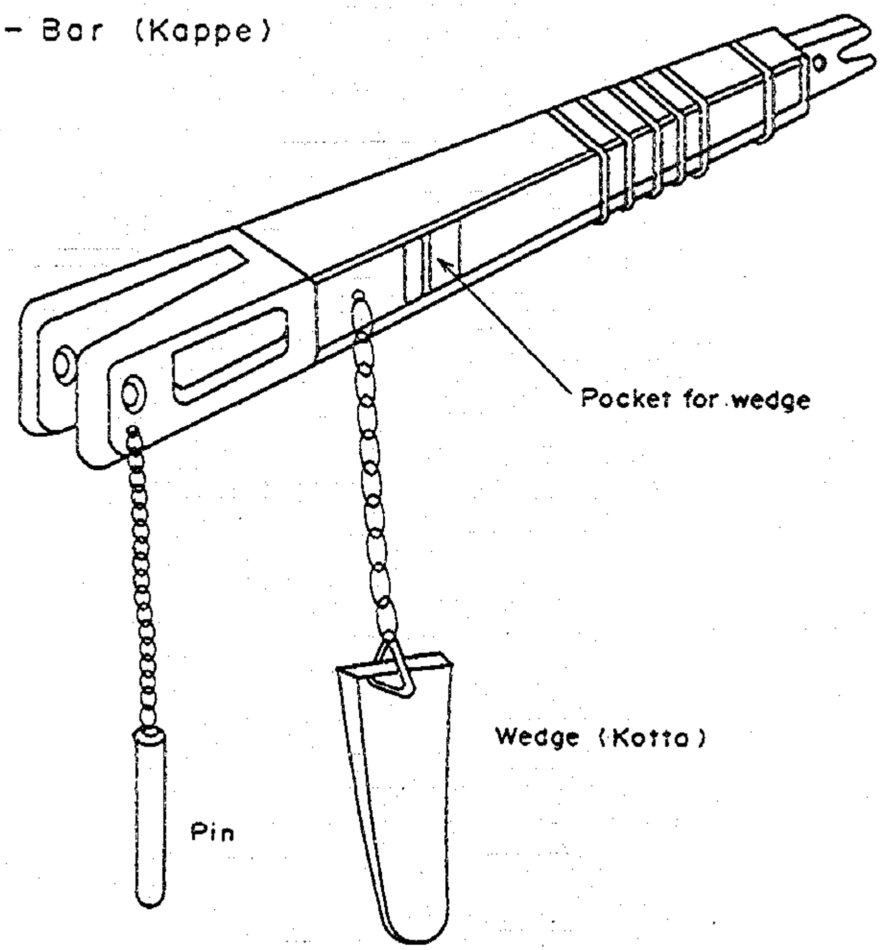
Making Bore Holes for Blasting

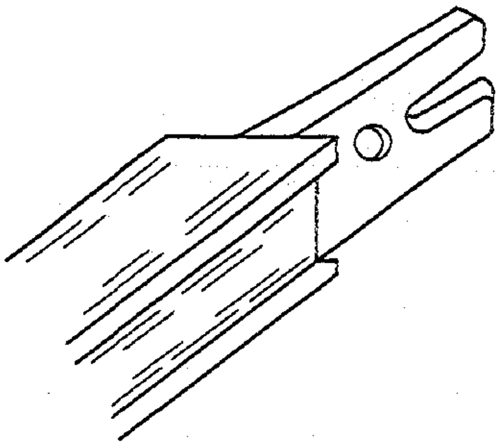


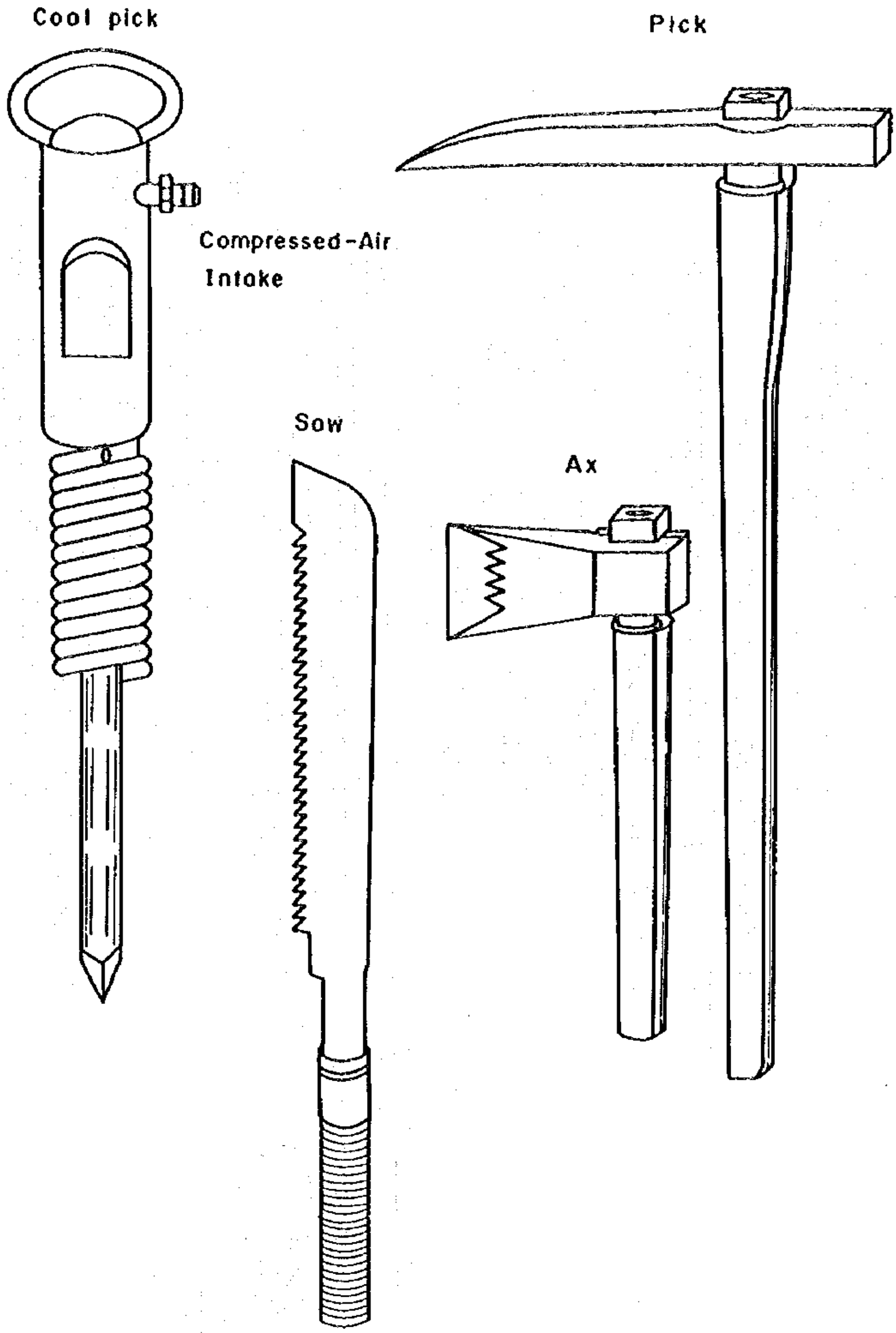
Hydraulic Prop



Link - Bar (Kappe)






Cool pick
Pick
Compressed-Air
Intake
Sow
Ax

Appendix 3. Details of the Mining Plan in the Mae Lamao Basin

Appendix 3 Mine Planning in the Mae Lamao Basin

(1) Workforce Plan

1. Open Pit

1-1. Workforce at Shift-1

	Kind of works	Workers	Staff	Senior	S-Chief	S-Total	Total
D	Operater for Dozer	4					4
I	Operater for FEL	2					2
R	Operater for B-hoe	2					2
E	Driver for Truck	8					8
C	Driver for Grader	1					1
T	Helper	9					9
	Total: Direct Workers	26	1	1	1	3	29
I	Safty Div			1		1	1
N	Mec & Elec Div.	4	2	1	1	4	8
D	Planing & Survey Div.	2	1			1	3
I	Warehouse	4	1			1	5
•	Accountant,Other	6	2			2	8
	Total: Indirect workers	16	6	2	1	9	25
Mine Management							
Actual workforce Total		42	7	3	2	12	54

Common workforce for O/P

Kind of works	Div.Chief	Manager	S-Total
Operater for Dozer			
Operater for FEL			
Operater for B-hoe			
Driver for Truck			
Driver for Grader			
Helper			
Total: Direct Workers	1		1
Safty Div	1		1
Mec & Elec Div.	1		1
Planing & Survey Div.	1		1
Warehouse			
Accountant,Other	1		1
Total: Indirect workers	4		4
Mine Management		2	2
Actual workforce Total	5	2	7

		Workers	Staff	Senior	S-Chief	S-Total	Total
*	Direct	29	1	1	1	3	32
Resitered Workforce	Indirect	18	6	2	1	9	27
	Total	47	7	3	2	12	59

* : Attendance rate of workers : 90%

1-2. Workforce at Shift-2, Shift-3

	Kind of works	Workers	Staff	Senior	S-Total	Total
D	Operater for Dozer	4				4
I	Operater for FEL	2				2
R	Operater for B-hoe	2				2
E	Driver for Truck	8				8
C	Driver for Grader	1				1
T	Helper	9				9
	Total: Direct Workers	26	1	1	2	28
I	Safty Div			1	1	1
N	Mec & Elec Div.	4	2	1	3	7
D	Warehouse	1	1		1	2
I	Accountant,Other	2	1		1	3
•	Total: Indirect workers	7	4	2	6	13
Actual workforce Total		33	5	3	8	41

		Workers	Staff	Senior	S-Total	Total
	Direct	29	1	1	2	31
Resitered Workforce	Indirect	8	4	2	6	14
	Total	37	5	3	8	45

1-3. Total Workforce per Day

	Shift	Worker			Staff *			Total *		
		Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Actual	1	26	16	42	3	9	12	29	25	54
	2	26	7	33	2	6	8	28	13	41
	3	26	7	33	2	6	8	28	13	41
	Total	78	30	108	7	21	28	85	51	136
Registered	1	29	18	47	3	9	12	32	27	59
	2	29	8	37	2	6	8	31	14	45
	3	29	8	37	2	6	8	31	14	45
	Total	87	34	121	7	21	28	94	55	149

* In the above number, seven (7) staff in common with underground mine are not included

2. Underground

2-1. Workforce at shift-1 (L/W: 1 team, Development: 2 teams)

	Kind of works	Workers	Staff	Senior	S-Chief	Di-Chief	MM,VMM	S-Total	Total
	Leader of Team	1							1
	Blasting	4							4
D	Standing Props	6							6
I	Removing Props	6							6
R	Shoveling Coal	4							4
E	Stable Room,other	4							4
C	Sub-Total : L/W	25	2	1	1			4	29
T	Roads Development	10	2					2	12
*1	Maintenance,other	20	2	1	1	1		5	25
	Total: Direct Workers	55	6	2	2	1		11	66
	Magazine	-	2					2	2
	Safety work	10	3	1	1	1		6	16
	Safety Div.	10	5	1	1	1		8	18
I	U/G Transportation	8	2					2	10
N	Slope Transportation	2		1				1	3
D	Surface works	20	2	1	1	1		5	25
I	Transportation Div.	30	4	2	1	1		8	38
R	U/G Mec & Electric	10	2	1				3	13
E	Surface Mec & Elec	8	2	1	1	1		5	13
C	Mec & Elec Div.	18	4	2	1	1		8	26
T	Planing & Survey Div.	6	4	2	1	1		8	14
	Warehouse	6	2	1	1			4	10
	Accountant,Other	30	6	3	3	1		13	43
	Non-Technical Div.	36	8	4	4	1		17	53
	Total: Indirect Workers	100	25	11	8	5		49	149
Mine Management							2	2	2
Actual Workforce Total		155	31	13	10	6	2	62	217

*2	Direct	65	6	2	2	1	-	11	76
Resitered Workforce	Indirect	111	25	11	8	5	-	49	160
	Total	176	31	13	10	6	2	62	238

Note : *1 Those who are related directly to production work.

*2 Resistered workforce = Actual workforce / Attendance rate.

Attendance rate : Direct workers - 85%, Indirect workers - 90%, Staff - 100%

2-2. Workforce at Shift-2, Shift-3 (L/W: 1 team, Development: 2 teams)

	Kind of works	Workers	Staff	Senior	S-Chief	S-Total	Total
	Leader of Team	1					1
	Blasting	4					4
D	Standing Props	6					6
I	Removing Props	6					6
R	Shoveling Coal	4					4
E	Stable Room,other	4					4
C	Sub-Total : L/W	25	2	1		3	28
T	Roads Development	10	2			2	12
	Maintenance,other	6	1	1	1	3	9
	Total: Direct Workers	41	5	2	1	8	49
	Magazine		2			2	2
	Safety work	2			1	1	3
I	Safety Div.	2	2		1	3	5
N	U/G Transportation	8	2			2	10
D	Slope Transportation	2				0	2
I	Surface works	10	1	1		2	12
R	Transportation Div.	20	3	1		4	24
E	U/G Mec & Electric	4	1			1	5
C	Surface Mec & Elec	4	1	1		2	6
T	Mec & Elec Div.	8	2	1		3	11
	Warehouse	2	1			1	3
	Accountant,Other	4					4
	Non-Technical Div.	6	1			1	7
	Total: Indirect Workers	36	8	2	1	11	47
Actual Workforce Total		77	13	4	2	19	96
Resiterod Workforce	Direct	48	5	2	1	8	56
	Indirect	40	8	2	1	11	51
	Total	88	13	4	2	19	107

2-3. Total Workforce per Day

	Shift	Worker			Staff			Total		
		Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Actual	1	55	100	155	11	51	62	66	151	217
	2	41	36	77	8	11	19	49	47	96
	3	41	36	77	8	11	19	49	47	96
	Total	137	172	309	27	73	100	164	245	409
Registered	1	65	111	176	11	51	62	76	162	238
	2	48	40	88	8	11	19	56	51	107
	3	48	40	88	8	11	19	56	51	107
	Total	161	191	352	27	73	100	188	264	452

(2). Cost Estimation

2-1 Capital Cost in US$ (Exchange Rate : 1US$ = 25 Baht)

2-1-1. Open Pit Mine

1) Surface Facilities and Equipment

	Facility & Equipment	Number	Unit Price	Total	Memo
1	Main Building	1	500,000	500,000	Common use with U/G
2	Warehouse	1	300,000	300,000	Common use with U/G
3	Workshop	1	500,000	500,000	Common use with U/G
4	Clean Coal Bin	1	100,000	100,000	Common use with U/G
5	Hand-picking Facility	1	200,000	200,000	Common use with U/G
6	Water Supply Facility	1	200,000	200,000	Common use with U/G
7	Land Purchase	100 ha		1,000,000	*1
	Total Price			2,800,000	

*1 : According to a farmer at site , 30,000-40,000 Baht/rai .
100 ha = 625 rai 625*40000 = 25,000,000 Baht = 1,000,000 US$

2) Mining Equipment

	Facility & Equipment	Number	Unit Price	Total	Memo	Life	Year to be invested
1	Bulldozer	3	500,000	1,500,000	D-155 306Hp	10	After O/P finish , no need
2	Bulldozer	1	350,000	350,000	D-85 228Hp	10	After O/P finish , 1 unit
3	Front End Loader	2	200,000	400,000	WA-300 2.5m3	10	After O/P finish , 1 unit
4	Back-hoe	2	200,000	400,000	PC-200	10	After O/P finish , no need
5	Off-road Truck	8	100,000	800,000		6	7th
6	Grader	1	150,000	150,000		6	7th
	Total Price			3,600,000			

3) Vehicles and Other Equipment at Surface   Common use with U/G

	Facility & Equipment	Number	Unit Price	Total	Memo	Life	Year to be invested
1	Commuter bus	2	100,000	200,000	Common use	8	9th , 17th , 25th
2	Service truck	2	35,000	70,000	Common use	8	9th , 17th , 25th
3	Patrol car	2	40,000	80,000	Common use	6	7th , 13th , 19th , 25th
	Total Price			350,000			

4) Total Initial Investment

1	Surface Facilities and Equipment	2,800,000
2	Mining Equipment	3,600,000
3	Transportation and Other Equipment at Surface	350,000
	Total	6,750,000

2-1-2. Underground Mine

1) Surface Facilities and Equipment

	Facility & Equipment	Number	Unit Price	Total	Memo
1	Explosives storage	1	200,000	200,000	
2	Air Compressor	2	300,000	600,000	300Hp*2
3	Raw Coal Bin	1	100,000	100,000	150T*1 , Tippler
4	Main Fan	1	150,000	150,000	About 200Hp
5	Main Winding Machine	1	600,000	600,000	About 600Hp
6	Sub-Winding Machine	1	150,000	150,000	About 100Hp
7	Box or Arch Culvert	624	2,000	1,248,000	
	Total Price			3,048,000	

2) Safety Equipment

	Facility & Equipment	Number	Unit Price	Total	Memo	Life
1	Safety Lamp	400	500	200,000	YL2000	5
	Lamp Charger	10	12,000	120,000	YL-5240-40	-
2	CO Mask	400	115	46,000	SR-50	3
3	Dust Mask	400	30	12,000	Filter 2/year	3
4	Oxygen Measure	6	2,100	12,600	GO-25KS	5
5	Methane Detector(6%)	70	1,360	95,200	Toka	-
	Methane Detector(100%	6	1,360	8,160	Toka	-
6	CO Detector	6	1,400	8,400	CM-600	5
7	Oxygen Apparatus	30	12,000	360,000	Rescue Team	-
8	Radio Communication	1	70,000	70,000		
9	U/G Telephone	1	50,000	50,000		
	Total Price			982,360		

3) Transportation

	Facility & Equipment	Number	Unit Price	Total	Memo	Life
1	Mine car	250	5,000	1,250,000	2m3	
2	Flat-car	10	5,000	50,000		
3	Men-ride slope-train	1	200,000	200,000		
4	Battery Locomotive	4	200,000	800,000	6T	
	Total Price			2,300,000		

4) Road Development

	Facility & Equipment	Number	Unit Price	Total	Memo	Life
1	Side-dumping Loader	4	250,000	1,000,000		
2	Chain Conveyor	2	50,000	100,000		
3	Local Fan	4	25,000	100,000		
4	Air Auger	8	1,500	12,000		
5	Rock Hammer	8	3,000	24,000		
6	Coal Pick	8	1,000	8,000		
7	Small Pump	20	2,000	40,000		
	Total Price			1,284,000		

5) Longwall Mining

	Facility & Equipment	Number	Unit Price	Total	Memo	Life
1	Hydraulic Prop	800	1,200	960,000	*2	6
2	Link Bar	800	300	240,000	*2	6
3	High-pressure Pump	2	150,000	300,000		
4	Armored Face Conveyer	2	70,000	140,000		
5	Chain Conveyer	2	50,000	100,000		
6	Air Auger	4	1,500	6,000		3
7	Rock Hammer	2	3,000	6,000		3
8	Coal Pick	6	1,000	6,000		3
	Total Price			1,758,000		

*2 : About 10% of numbers should be purchased every year because of loss and damage .

6). Others

	Facility & Equipment	Number	Unit Price	Total	Memo	Life	Year to be invested
1	Fixed Pump	2	30,000	60,000		10	
2	Small Back-hoe	4	50,000	200,000		6	
3	Survey Implements	1	50,000	50,000			
4	Boring Machine	1	70,000	70,000		6	
5	Grouting Pump	2	35,000	70,000		6	
				450,000			

7) Total Initial Investment

1	Surface Facilities and Equipment	3,048,000
2	Safety Equipment	982,000
3	Transportation	2,300,000
4	Road Development	1,284,000
5	Longwall Mining	1,758,000
6	Others	450,000
	Total	9,822,000

2-2 Operation Cost in US$ (Exchange Rate : 1 US$= 25 Baht)

2-2-1. Open Pit Mine (Annual production 200,000 tons)

1) Consumer Material Cost

(1).	Fuel	: 8 litter/ton (Stripping Ratio 1 : 8 , 9 Baht/l = 0.36 US$/l) 200,000 * 8* 0.36 = 576,000 US$/year	576,000
(2).	Lubricant	: 10% of Fuel Consumption , 57,600 US$/year	57,600
(3).	Parts	: 15% of Mobil Equipment Price , 410,000 US$	410,000
(4).	Others	: 30,000 US$/year	30,000
			1,073,600

2) Electric Power Cost (1.03 Baht/kWh = 0.04 US$/kWh)

	days	kW/h	24 hrs/day	kWh/Year	Unit Cost	Cost/Year
Working day	250	100	24	600,000	0.04	24,000

3) Personnel Cost

Worker : 238 Baht = 9.52 US$/day
Staff : 8125 Baht = 325 US$/month

	Wage	Salary	*1	*2	*3	*4	Total
Worker	9.52	-	2,380	595	2,975	121	359,975
Staff	-	325	3,900	975	4,875	35	170,625
							530,600

*1 : Basic pay / person / year
*2 : Overtime , Insurance , etc. 25 % of Basic pay
*3 : Total Pay / person / Year
*4 : Numbers of workforce

4) Total Operating Cost

	Total cost
1. Consumer Material Cost	1,073,600
2. Electric Power Cost	24,000
3. Personal Cost	530,600
4. Others	500,000
	2,128,200

Unit Operating Cost : 2,128,200$ / 200,000tons = 10.64 $/Ton

2-2-2 Underground Mine

1) Consumer Material Cost for Road Development (Support distance : 1 m , US$/m)

	1st Step				2 st Step *
Material	Number	Unit Price	Total	Memo	Total
Steel Support	1	150	150	1 Set (3 pieces)	75
Bracing wood	10	1	10	10 ps (Left side 3 , Right side 3 , Roof 4)	10
Wood plate	24	2.5	60	24 ps (Left side 6 , Right side 6 , Roof 12	60
Tension bar	10	2	20	10 ps (Left side 3 , Right side 3 , Roof 4)	10
Detonator cap	34	2	68	34 ps	68
Explosive	40	2	80	40 ps (200g /piece)	80
Rail	2	60	120	Including Fish-plate	60
Slipper wood	2	15	30	2 ps	30
Air pipe	1	12	12	Φ 4~8 inches	6
Water pipe	1	6	6	Φ 2 inches	3
Drainage pipe	1	6	6	Φ 2 inches	3
Power cable	1	80	80	Cabtire Cable	40
Others		20	20	Air hose , Water hose , Tampimg-material	20
			662		465

* In later stage consumer material cost will reduce by means of reuse of some materials.
2nd Step : 50% of Steel Supports , Tension bars , Rails , Pipes , Cables are reused.

2) Consumer Material Cost For Longwall (US$/Ton)

Material	Number	Unit Price	Total	Memo
Wood plate	0.01	400	4	m3/ton
Wire net	0.60	5	3	m2/ton
Detonater cap	1	2	2	piece
Explosive	1	2	2	piece
Others		1	1	Air hose , Water hose , Tampimg-materials , etc
			12	

2-3. Consumer Material Cost for Road Maintenance (US$/m)

Material	Number	Unit Price	Total	Memo
Steel Support	0.1	150	15	1 Set (3 pieces)
Bracing wood	10	1	10	10 ps (Left side 3 , Right side 3 , Roof 4)
Wood plate	24	2.5	60	24 ps (Left side 6 , Right side 6 , Roof 12)
Slipper wood	0.4	15	6	2 ps
Others		10	10	
			101	

4) Electric Power Cost (1.03 Baht/kWh = 0.04 US$/kWh)

	days	kW/h	24 hrs/day	kWh/Year	Unit Cost	Cost/Year	
Working day	250	1,200	24	7,200,000	0.04	288,000	
Unworking d	115	500	24	1,380,000	0.04	55,200	Ventilation, Drainage
	365			8,580,000		343,200	

5) Personnel Cost

From study 1993 (Mining Industry , Wage/day = 183 Baht , Salary/month = 6250 baht)

Inflation rate% , 1997 base is 30% UP .

Worker : 238 Baht = 9.52 US$/day

Staff : 8125 Baht = 325 US$/month

	Wage	Salary	*1	*2	*3	*4	Total
Worker	9.52	-	2,380	595	2,975	352	1,047,200
Staff	-	325	3,900	975	4,875	100	487,500
							1,534,700

*1 : Basic pay / person / year

*2 : Overtime , Insurance , etc 25 % of Basic pay

*3 : Total Pay / person / Year

*4 : Numbers of workforce

6) Total U/G Operating Cost

In case of 5th year

		Production	Unit cost	Total cost	
1	Consumer Material Cost for Road Development	(870m) 11,643	465	404,550	10.28%
2	Consumer Material Cost for Long Wall	102,538	12	1,230,456	31.28%
3	Consumer Material Cost for Road Maintenance	800	101	121,200	3.08%
4	Electric Power Cost			343,200	8.72%
5	Personal Cost			1,534,700	39.01%
6	Others (Parts of Machines , etc)			300,000	7.63%
		114,181		3,934,106	100.00%

Unit Running Cost : 3,934,106$ / 114,181tons = 34.45 $/Ton

7). Alternate Estimated Running Cost at Mae Lamao U/G (US$)

* Instead of wood plates and iron net , it ia possible to use bamboos (like as bamboo blind)

Comsumer Material Cost : Road development

2nd Step : 50% of Steel Supports , Tension bars , Rails , Pipes , Cables are supplyed by removed ones .

Material	Number	Unit Price	Total $	Memo
Steel Support	0.5	150	75	1 Set (3 pieces)
Bracing wood	10	1	10	10 ps (Left side 3 , Right side 3 , Roof 4)
Bamboos	7	1	7	5 rolls (Left side 2 , Right side 2 , Roof 3)
Tension bar	5	2	10	10 ps (Left side 3 , Right side 3 , Roof 4)
Detonater cap	34	2	68	34 ps
Explosive	40	2	80	40 ps (200g /piece)
Rail	1	60	60	Including Fish-plate
Slipper wood	2	15	30	2 ps
Air pipe	0.5	12	6	Φ 4~8 inches
Water pipe	0.5	6	3	Φ 2 inches
Drainage pipe	0.5	6	3	Φ 2 inches
Power cable	0.5	80	40	Cabtire Cable
Others		20	20	Air hose , Water hose , Tampimg-materials , etc
			412	

Consumer Material Cost : Long Wall (US $/t)

Material	Number	Unit Price	Total $	Memo
Bamboos	2	1	2	roll/ton
Detonater cap	1	2	2	piece
Explosive	1	2	2	piece
Others		1	1	Air hose , Water hose , Tampimg-materials , etc
			7	.

In case of 5th year

* Productivity becomes Japanes coal mine with similar natural condition .

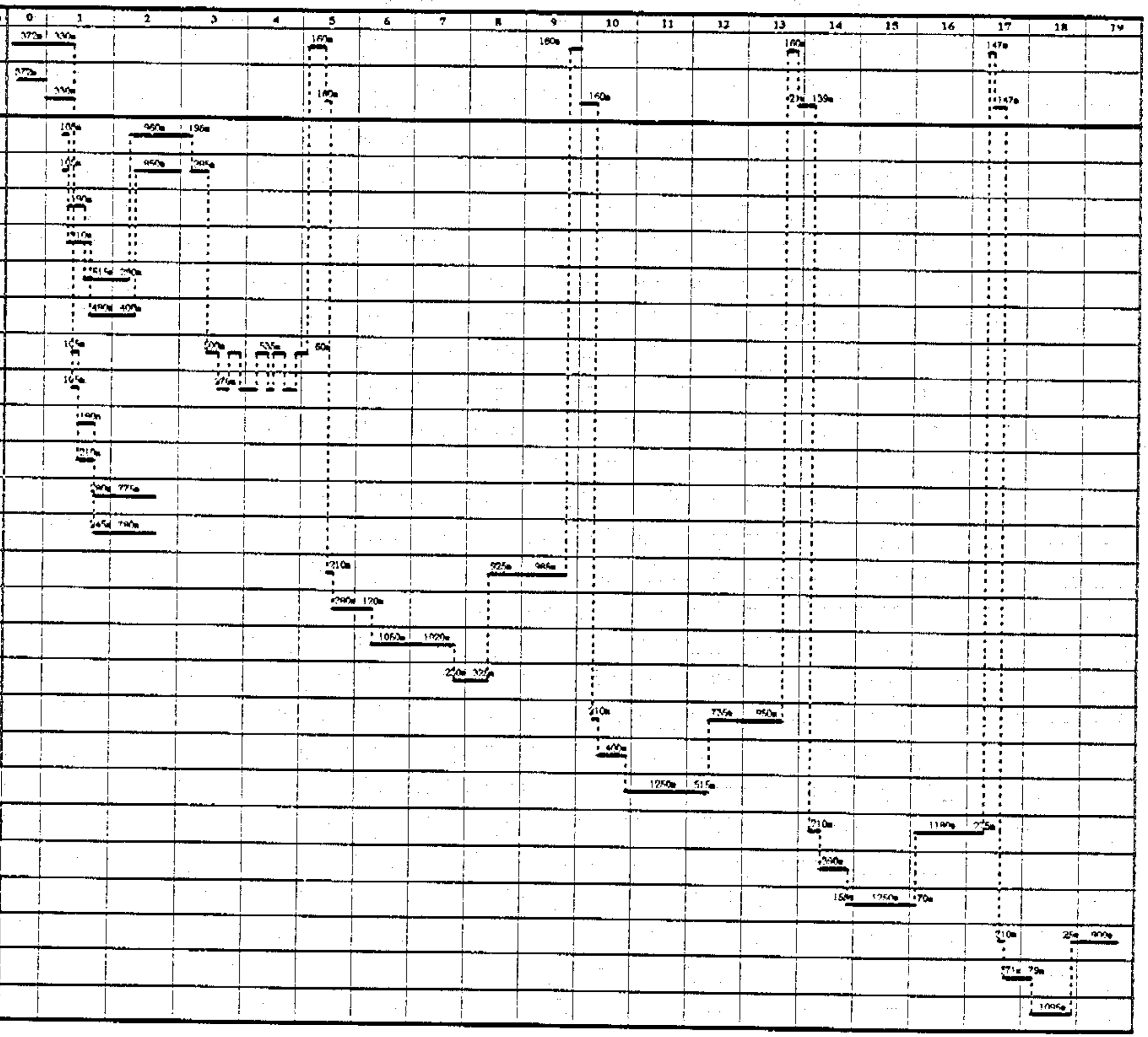
⇒ Road : 2.5 times , Long wall : 2 times

		Production	Unit cost	Total cost
1	Consumer Material Cost for Road Development	(2,225m) 29,108	412	916,700
2	Consumer Material Cost for Long Wall	205,076	7	1,435,532
3	Consumer Material Cost for Road Maintenance	(1,600m)	101	161,600
4	Electric Power Cost			343,200
5	Personal Cost			1,534,700
6	Others (Parts of Machines , etc)			300,000
		234,184		4,691,732

Unit Running Cost : 4,691,732$ / 234,184tons = 20.03 $/ton

(3) Development Schedule

Panel	Coal, rock	Dev.(m)	Prod.(t)
Main	culvert	252	
	coal	957	18,885
Submain	culvert	372	
	coal	957	18,885
N-0L:A	coal	1,260	24,965
N-0L:B	coal	1,240	24,470
0L:A-bypass	rock	400	
0L:B-bypass	rock	190	
S-0L:A	coal	885	15,886
S-0L:B	coal	880	17,364
N-1L:A	coal	1,140	22,497
N-1L:B	coal	1,120	22,102
1L:A-bypass	rock	190	
1L:B-bypass	rock	210	
S-1L:A	coal	1,055	20,819
S-1L:B	coal	1025	20,227
N-2L	coal	2,120	41,836
2L:bypass	rock	400	
S-2L	coal	2,070	40,849
S-2L	coal	555	10,952
N-3L	coal	1,095	37,100
3L:bypass	rock	400	
S-3L	coal	1,075	37,001
N-4L	coal	1,665	32,857
4L:bypass	rock	390	
S-4L	coal	1,475	29,107
N-5L	coal	1,135	22,390
5L:bypass	rock	250	
S-5L	coal	1,095	21,600



Appendix 4. The Tertiary deposits-Phrae Formation-in the Phrae Basin

Appendix 4

The Tertiary deposits-Phrae Formation-in the Phrae Basin

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ABSTRACT

Coal exploration in the Phrae Basin by means of geological mapping, drilling and interpretation of seismic profiles has revealed its Cenozoic stratigraphy. The Phrae Formation-new denomination to the Tertiary deposits-is unconformably overlain by Quaternary fluvial deposits. The Phrae Formation forms peculiar landscape in the wellknown national park; namely Phae Mueng Phi, which was previously undetermined in geologic age.

The Phrae Formation is subdivided into fan and occasionally intercalated lacustrine lithofacies.

The fan lithofacies consist of severely weathered breccias of argillaceous rocks derived from the basement with frequent intercalations of thin fluvial conglomerate. As being observed in the national park, weathered breccias form homogeneous gritty mudstone. However visual observation of drilled cores revealed that the breccias gradually become fresh toward the basement.

The lacustrine deposits are characterized by sandstone, mudtone and lignite beds with calcareous concretion, molluscan fossil bed and sedimentary structures such as laminae and fining upward.

INTRODUCTION

Under the agreement between the Japan International Cooperation Agency and Department of Mineral Resources, Ministry of Industry of the Government of the Kingdom of Thailand, the study team which consists of geologists of both countries has been conducting coal exploration in the Phrae Basin since 1995.

The previous geological literature of the Phrae Basin is restricted to the geological maps of Geological Survey Division, Department of Mineral Resources. The published one of scale 1:250,000 describes the significantly large area of Tertiary rocks in the northeastern basin. However the new one fo 1:50,000 which is unpublished yet describes Quaternary deposits throughout the basin. The outcrops in the northern and periphery of the basin are determined to be Tertiary correlating to the lithofacies of boreholes which were drilled in the southern basin. Tertiary stratigraphy of the intermontane basins in the northern Thailand is typified at the Mae Moh Basin, and similar stratigraphy is recognized in several basins. It is subdivided into basal conglomeratic facies, coal-bearing facies and lacustrine argillaceous facies in the ascending order. However quite different stratigraphy of fan deposits with occasional intercalations of lacustrine deposits is identified in the Phrae Basin. Also previously undetermined geologic age for the outcrop of the national park is detemined to be Tertiary.

GEOGRAPHY

The phrae Basin is located approximately 480 km north of Bangkok as shown in Figure 1. The basin is elliptic with NNE-SSW long axis of 60 km and WNW-ESE

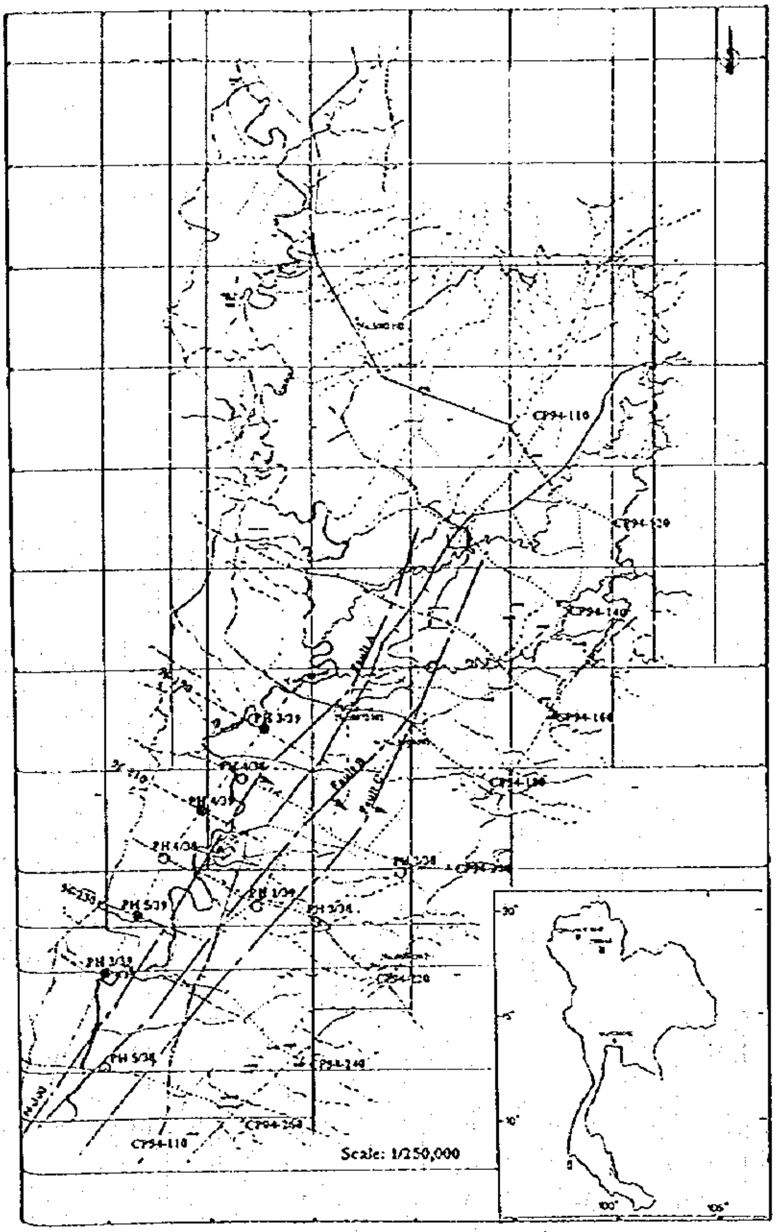


Figure1 Location of the Phrae Basin.

short axis of 15 km with a subbasin stretching 20 km toward north. The basin is surrounded by relatively gentle mountain ranges ranging from 500 m to 1,000 m in altitude. The surface of the basin is a nearly flat slope ranging from 200 m at the north and 150 m at the south in altitude. The basin consists of northeastern gentle hilly area and another flat area. The Yom River (Mae Nam Yom) flows from the northern subbasin to the western side of the basin and gathers its tributary systems, which flow into the basin from east and west.

The northeastern hilly area is utilized for extensive farming for maize, sugar cane and stock farming. The other flat area is utilized exclusively for paddy fielde and housing. For the purpose of rice farmining, water resources are utilized with the well developed irrigation systems such as dams and canals throughout the basin.

STRAIGRAPHY

Stratigraphy of the Phrae Basin is subdivided as follows:

Geologic age	*Deposits*
Quaternary	Alluvium Residual deposits & Superficial deposits Diluvium ~~~~ Unconformity
Tertiary	Phrae Formation ~~~~ Unconformity
Triassic~ Silurian	Ratburi Group~ Donchai Group (basement for the Tertiary deposits

Ratburi, Mae Tha and Donchai Groups

The Phrae Basin is surrounded by mountain ranges of basement rocks, which consist of three groups ranging from Silurian to Triassic in geologic age. According to the geological map of scale 1:250,000 the basement rocks comprise mainly of argillaceous rocks such as shale with a minor amount of sandstone, chert, limestone, quartzite, tuffaceous rocks and acidic tuff. These basement rocks were eroded and deposited in the Phrae Basin forming the Phrae Formation. Most of Coarse clastics in the Phrae Formation are slate or phyllite with additional amount of chert, quartzite and limestone. In the northeastern part of the basin, an outcrop which consists of slate with quartzite breccias was observed. It looks like tillite or turbidite (Fig.4). Further detailed mapping will be able to determine its origin.

Phrae Formation

The Tertiary formation in the Phrae Basin has not been denominated yet. Due to its difference in lithofacies from Mae Moh which represents the standard lacustarine stratigraphy of the intermontane coal basins in northern Thailand, the Phrae Formation is proposed to denominate the Tertiary formation. The difference in lithofacies is shown in Table 1.

Fan lithofacies

Gritty mudstone with consists of mud and a little amount of granules of chert in the national park (Fig.2 and 5) and outcrops along the western periphery (Fig.6) was geologically unbelievable due to its incompatible two components i.e. mud and granules. It is understood that mud was transported by suspension and deposited under the low energy regime compared to granules, which were transported by bed load and deposited under the stroug energy regime.

This question was solved by visual logging of the borehhole cores, which were recovered from 6 boreholes in the southern part of the basin. As shown in Figure 7 and 8, the shape of weathered breccias of slate of phyllite gradually became apparent toward deeper the boreholes. And finally the slightly weathered bedrock of phyllite was recovered as shown in Figure 9. Then gritty mudstone of the outcrops was concluded to be extremely weathered breccias of argillaceous rocks. Same deposits of phyllite breccias were observed at the foothills of the surrounding mountain ranges. Where breccias were deposited thick and form detritus.

The same weathered breccia bed was observed at the base of the Huai Luang Formation at Mae Moh Mine (Fig.10). The weathered breccia bed which also contains well rounded quartzite pebbles rests disconformably on the lignite-bearing Na khaem Formation. Due to little difference in grologic structure for the both formatons, disconformity is rather applicable than unconformity to this boundary.

The weathered breccia bed (gritty mudstone) frequently intercalates thin conglomerate with consists of chert and quartzite gravels ranging from cobble to sand in size as shown in Figures 5 and 11. Low angle planar laminae in it and convolution at the bottom suggest transportation and deposition under the strong energyy regime.

The weathered breccia bed, which is similar to Recent detritus, and the intercalated thin conglomerate bed indicate their lithofacies of fan.

Lacustrine lithofacies

The fan lithofacies occasionally intercalates the interval, which consists of well bedded, laminated or massive sedimentary rocks such as sandstone (Fig.12 and 13), mudstone and lignite in addition to thin fan lithofacies. Also the molluscan fossil bed,

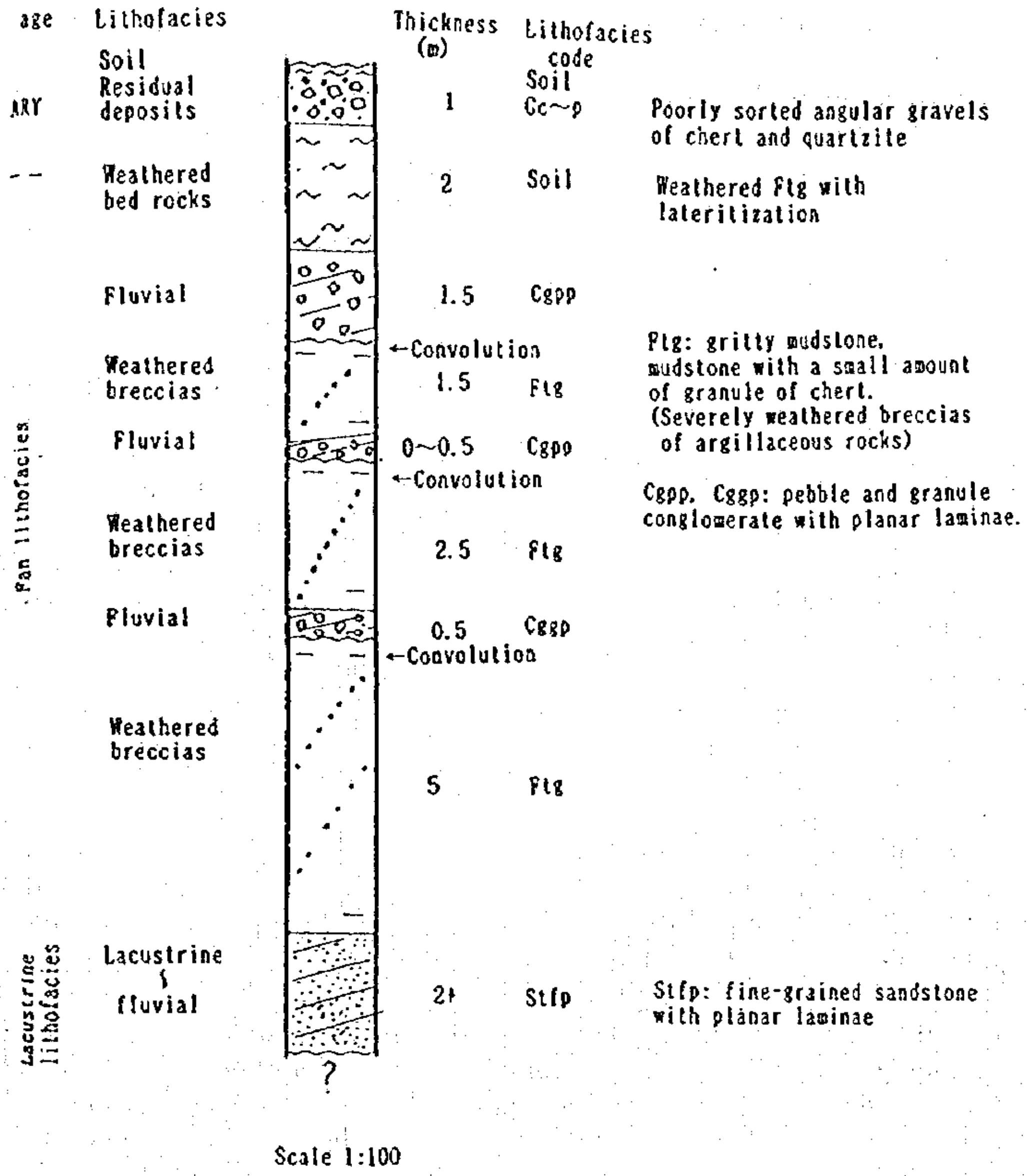


Figure 2 Lithofacies log of the outcrop in the national park.

calcareous band and carbonaceous laminae in this interval indicate lacustrine environment. However fining upward sandstone was probably deposited along the fluvial channels and small deltas in the marginal area of lacustrine environment. In the Phrae Basin, the lacustrine lithofacies is detected by seismic exploration as strong reflectors, and fan lithofacies ans homogeneous zone in general. The lacustrine lithofacies is interpreted to occur from L-2, L-1, LA, LB, LC and LD in the ascending order as shown in Figure 3. Reflectores of the seismic profiles are correlated to the borehole logs as shown in Plate 1. The lacustrine lithofacies generally intercalates carbonaceous mudstone and lignite bed. Especially LB and LC intercalate the relatively thick lignite beds in the southwestern part of the basin.

Geologic age of the Phrae Formation was determined to be from not older than Miocene to not older than Middle Miocene in the ascending order by palynological analysis.

Diluvium

The previous geological maps describe large areas of the Pleistocene Mae Taeng Formation as terrace deposits mainly in the northern part of the basin. However many outcrops of the Phrae Formation were found in the area as shown in Figure 13. The terrace

Table 1 Different lithofacies of the Phrae Formation in the region..

Mae Moh Basin	Phrae Basin
Quaternary	Quaternary
~ ~ ~ ~ ~ ~ ~ ~ Unconformity	~ ~ ~ ~ ~ ~ ~ ~ Unconformity
Huai Luang Form. Red mudstone (C) Thin conglomerae$^{(w)}$	Phrae Form. Fan deposits with occasional intercala-tions of lacustrine deposits
~ ~ ~ ~ ~ ~ ~ ~ Disconformity	
Na Khaem Form. Lignite-bearing (B)	
Huai King Form. Coarse clastics (A)	
~ ~ ~ ~ ~ ~ ~ ~ Unconformity	~ ~ ~ ~ ~ ~ ~ ~ Unconformity
Permo-Triassic basement	Silurian ~ Triassic basement

(w) weathered conglomerate or detritus. Gravels and breccias in these deposits were weathered to mudstone due to their composition of argillaceous rocks such as slate of phyllite.
(A) Conglomeratic facies
(B) lignite-bearing facies
(C) Lacustrine argillaceous facies

deposits were identified at two outcrops in the northwestern area and four boreholes in the southern area. At an outcrop of the northern side of highway 103 (Outcrop No. 5082102, Fig.14), a thick well rounded and sorted cobble bed unconformably rests on the steeply dipping bioturbated sandstone of the Phrae Formation. The other outcrop is observed at the western bank of a dam in the northern subbasin (Outcrop No. 5082501), where a cobble bed unconformably rests on the Phrae Formation. In the southern area, four boreholes which drilled from the paddy surface level penetrated the gravel bed of significant thickness ranging from 260 m to 65 m. Geophysical logs indicate several repetitions of the fining upward deposits.

The occurrence of gravel bed indicates the distribution of the Diluvium mainly in the western part of the basin under the Yom River (Mae Nam Yom).

Residual deposits

The outcrops of the Phrae Formation are mostly underlain by poorly sorted angular gravels of mainly chert and quartzite as shown in Figure 15. Gravels do not have sedimentary structure at most of the outcrops, but vague troung lamination was observed at some outcrops as shown in Figure 15. This gravel bed is concluded that gravels contained in the fan lithofacies, especially fluvial conglomerate, remained through weathering at the land surface as residual deposits. On the other hand, mud which were formed from severely weathered breccias derived from basement of argillaceous rocks was washed out.

This gravel bed might be slightly transported locally during heavy rain forming vague trough lamination. Such kind of residual deposits by weathering are, in general, eliminated in geological map.

Alluvium

except paddy field and talus along the periphery of the basin, the significant Recent deposits have not been observed in the basin due to intrenching nature of the Recent rivers. Probably the river system in the basin formed thin natural levee sand deposits along the existing of abandoned channels. The older housing sites which extend along meandering lines in paddy field might be selected on these levees.

GEOLOGIC STRUCTURES

As shown in Figure 3, main geologic structures are determined by progressing exploration with interpretation of the previous seismic profiles. They are as follows:

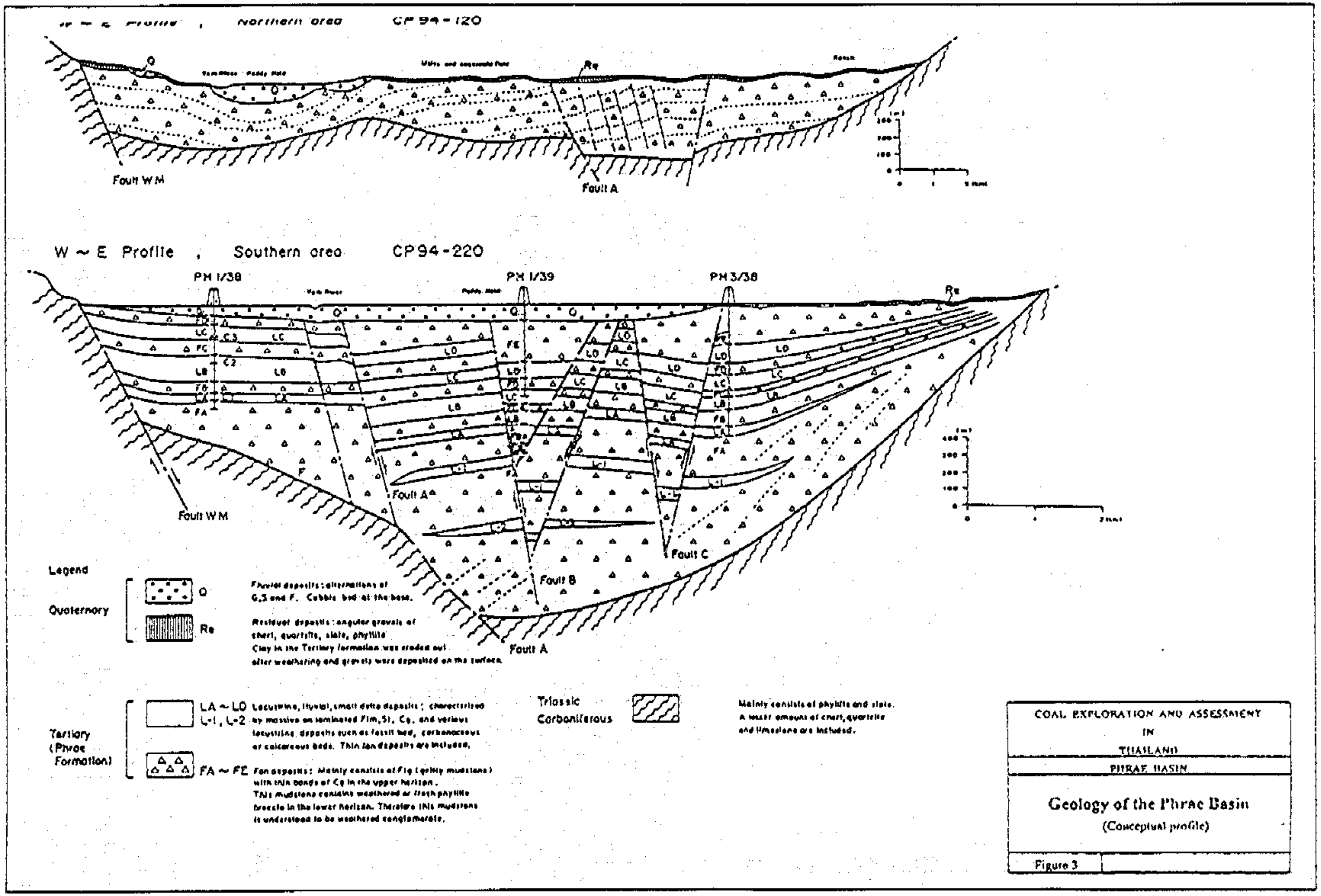
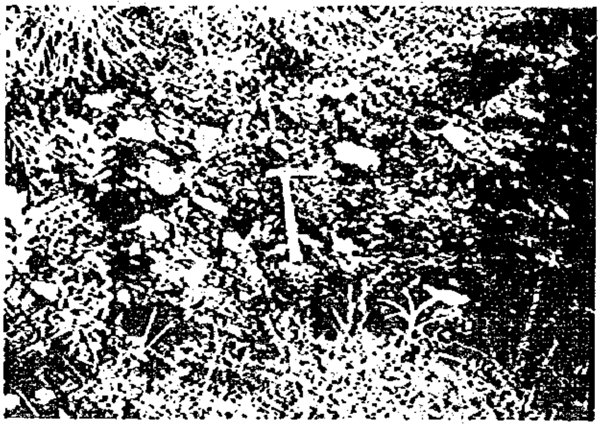


Figure3 Geology of the Phrae Basin (Conceptual profilel).



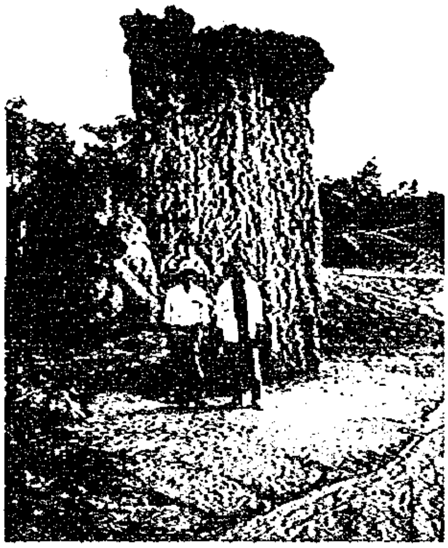


Figure 4 (top) Outcrop of the basement, slate with quartzite breccias.
Figure 5 (center) Outcrop of the Phrae Formation, gritty mudstone with intercalated thin conglomerate in the national park.
Figure 6 (bottom) Outcrop of the Phrae Formation at the western periphery of the basin.

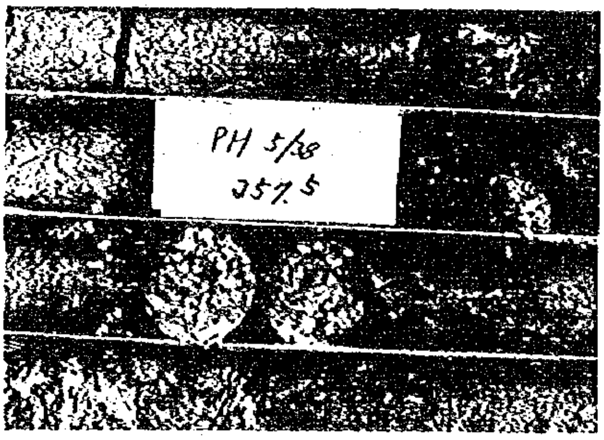
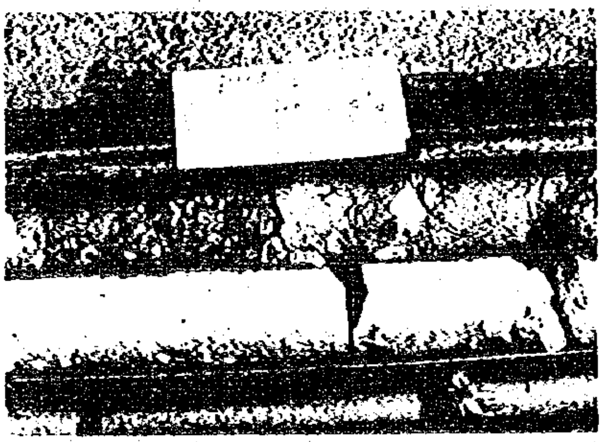


Figure 7 (top) Weathered breccias of argillaceous rocks, PH2/38-613.8 m.
Figure 8 (center) Ditto, PH5/38-257.5m.
Figure 9 (bottom) Phyllite, basement of the Phrae Formation, PH2/38-685.3 m.



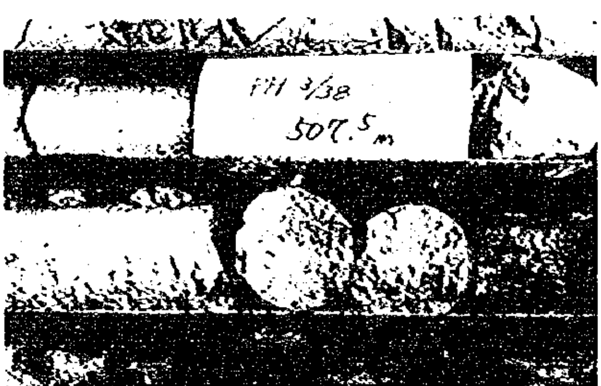


Figure 10 (top) Weathered breccias at the base of the Huai Luang Formation at Mae Moh Mine.
Figure 11 (center) Fluvial gravel bed in fan lithofacies, PH3/38-357 m.
Figure 12 (bottom) Sapropelitic massive fine-grained sandstone in lacustrine lithofacies of the Phrae Formation, PH3/38-507.3 m.

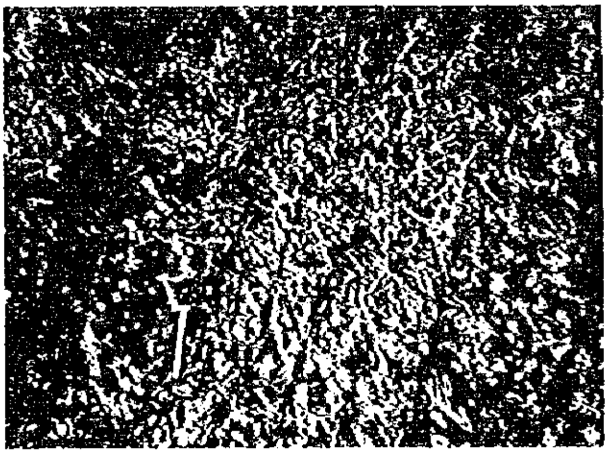


Figure 13 (top) Outcrop of the Phrae Formation at outcrop No.5073101 in the centre of the basin.
Figure 14 (center and bottom) Outcrop of Diluvium which unconformably rests on the steeply dipping Phrae Formation at outcrop No.5082102 in the northern area.

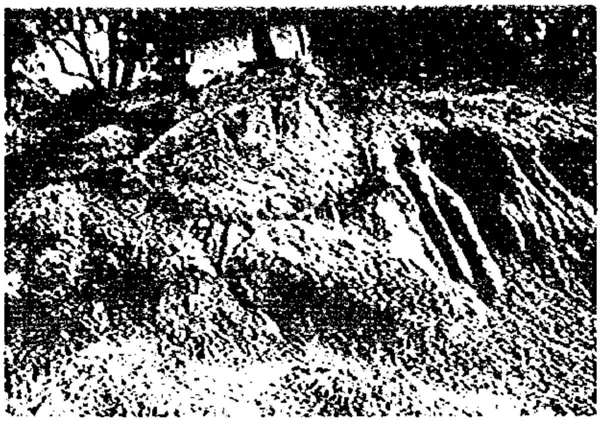


Figure 15 Outcrop of the residual deposits which suggest slight transportation of gravels at outcrop No.5080201 in the southeastern area.

The eastern periphery of the basin

The seismic profiles reveal the Phrae Formation of its gradual thinning, steeply dipping and abutting against the basement at the eastern periphery of the basin.

The western periphery of the basin

The seismic profiles reveal that Fault WM (Western Margin Fault) delineates the western periphery. Therefore the Phrae Basin is concluded to be a typical semi-graben basin.

Fault A

Fault A is revealed by the seismic profiles passing the western side of the basin (approximately along the Yom River) from NNE to SSW as shown Figure 3. The western side of Fault A, between Fault WM and Fault A, is rather flat and stable compared to the eastern side. The restricted occurrence of the lowermost Phrae Formation to the eastern side of this fault suggests an initial geologic structure which originated the Phrae Basin.

Fault B and Fault C

These faults are revealed by the seismic profiles occurring parallel to Fault A. The conjugated faults which dip toward NNW are also revealed in the seismic profiles.

SEDIMENTARY ENVIRONMENT

The dominating fan lithofacies of the Phrae Formation indicates that the subsidence of the basin was incessantly filled up with breccias derived from the basement. Compared to other basins which consist of thick lacustrine argillaceous deposits, the hinterland of the Phrae Basin might be uplifting fast so as to be able to supply breccias incessantly. Fan lithofacies seems to be more dominant in the northern and eastern side of the basin. During the deposition of fan, many fluvial channels frequently transported siliceous gravels probably from faraway and distributed them on the fan surface forming conglomerate beds.

When supply of breccia lessened lacustrine and fluvial lithofacies might be deposited in ephemeral lakes formed at the foo of fans. Lacustrine and fluvial lithofacies were also observed in the northern and eastern part o the basin as shown in Figures 2, 13 and 14. Bu the lignite beds occur mainly in the southern part of the basin. Especially the relatively thick lignite beds were drilled in the southwestern part. The eastern side of Fault A seems to have been subsiding faster than the western side and did not have calm periods to sustain peat swamp long enough to grow thick lignite beds.

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