# THE KINGDOM OF THAILAND NATIONAL ENERGY ADMINISTRATION MINISTRY OF SCIENCE, TECHNOLOGY AND ENERGY

# NAM MAE YUAM HYDROELECTRIC DEVELOPMENT PROJECT FEASIBILITY REPORT

VOLUME II

(Appendix 1,2,3,4,5)

MARCH, 1984

JAPAN INTERNATIONAL COOPERATION AGENCY



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国際協力事業団 122 64.3 MPN

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## A1 GEOLOGY

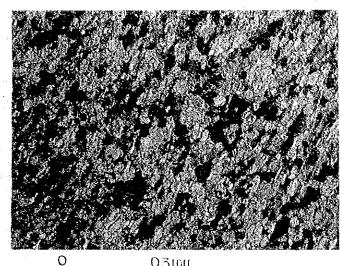
#### Micrograph and Petrographic Description of Rock (Plate 1 of 5)

Locality: 5 600 m upstream of A dam axis, right bank of Yuam River.

Rock name:

Limestone (massive)

Petrographic description:



(crossed nicols)

Chief consisting minerals are calcite >> muscovite, quartz and

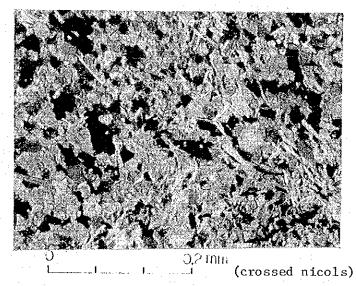
chlorite. Dolomite and potassium feldspar are trace in amount.

Locality: 9

200 m upstream of A dam axis, right bank of Yuam River. (EL. 150 m)

Rock name:

Limestone (laminated)



Petrographic description:

Chief consisting minerals are calcite > white mica, quartz. Banding texture consisting of calcite-rich and mica-rich layers is observed.

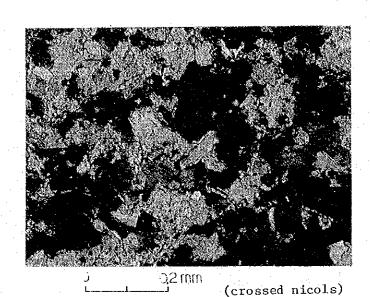
#### Micrograph and Petrographic Description of Rock (Plate 2 of 5)

Locality: 13

1 km downstream of A dam axis, left bank of Yuam River.

Rock name:

Sandy limestone



Petrographic description:

Chief consisting minerals are calcite, dolomite, quartz and muscovite.

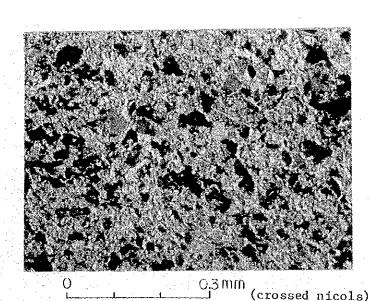
Locality: 16

Tributary of Huai Uya Kra (EL. 460 m)

Rock name:

Siliceous limestone

(or calcareous sandstone)



Petrographic description:

Chief consisting minerals are calcite, quartz and white mica.

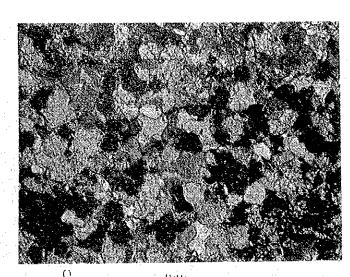
Clay minerals are trace in amount, less than 0.1%.

#### Micrograph and Petrographic Description of Rock (Plate 3 of 5)

Locality: 18 Huai Uya Kra

Rock name:

Calcareous sandstone



Petrographic description:

(crossed nicols)

Chief consisting minerals are dolomite, calcite, quartz. Accessory minerals are muscouvite and pyrite.

Locality: 20 Huai Mae Lamu

Rock name:

Sandstone



Petrographic description:

O2MM (crossed nicols)

Chief consisting minerals are quartz, dolomite and plagioclase.

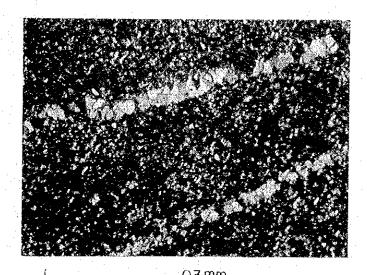
A trace amount of montmorillonite is found.

#### Micrograph and Petrographic Description of Rock (Plate 4 of 5)

Locality: 19

Right bank of A dam axis

Rock name: Shale



Petrographic description:

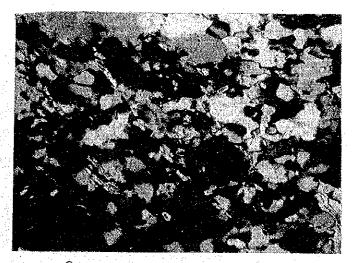
O3mm (crossed nicols) Chief consisting minerals are quartz, white mica, graphite and plagioclase. Quartz veins are common.

Locality:

Huai la cho Kra (about 5 km upstream of Damsite A)

Rock name:

Quartzose sandstone



Petrographic description:

0,2 mm (crossed nicols) Chief consisting minerals are quartz, potassium feldspar and muscovite. A trace amount of tourmaline, zircon and apatite is found.

#### Micrograph and Petrographic Description of Rock (Plate 5 of 5)

Locality:

Damsite C (about 12 km upstream of Damsite A)

Rock name: Granite



Petrographic description:

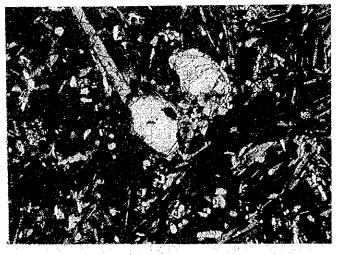
(crossed nicols) Chief consisting minerals are quartz, potassium feldspar, plagioclase, biotite and muscovite. Mica is partly replaced by chlorite and montmorillonite.

Locality:

Ngao river (about 3 km upstream of junction of Yuan river and Ngao river)

Rock name:

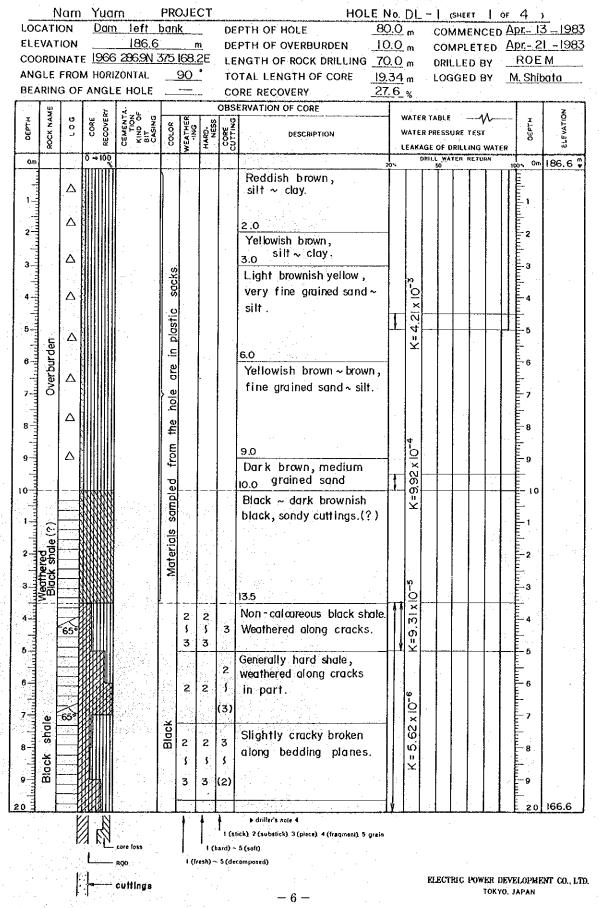
Basa1t



Petrographic description:

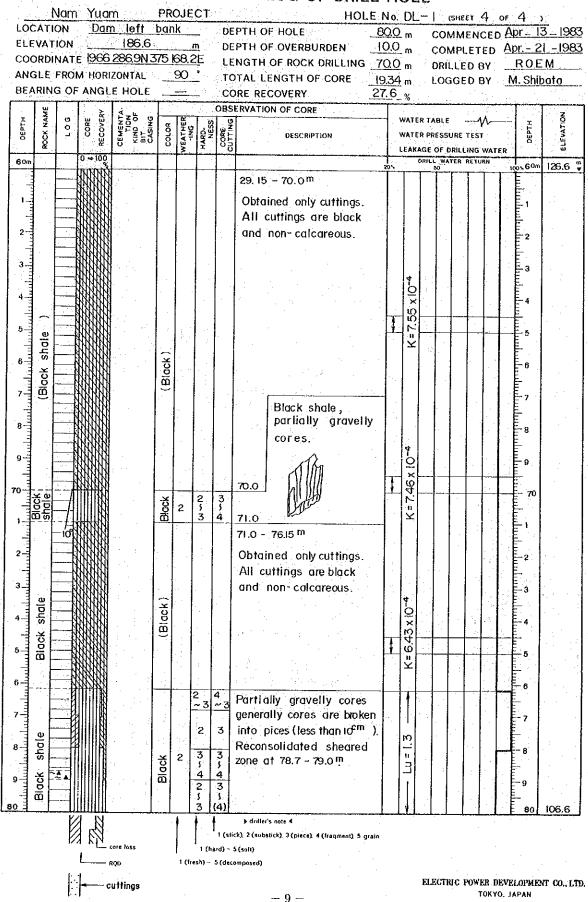
O5mm (crossed nicols) Phenocrysts are of olivine, plagioclase and clinopyroxne.

Microphenocrysts are of plagioclase, clinopyroxne and magnetite.



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				ZONTAL						34			OGG			M	l. Shi	bata
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1 1	স্ত	-60			Black	Ş	2	5	solusion.		11			1.			1	
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2	_ m_				_	_	3	3^4	22.1	┧.	Ø						2	
								3 3~4	Generally weathered color (dark brown~ reddish brown		7=t		.				3	
3-1							2.	3	along cracks and some	1	ĮΞ							
4 4		60	翔				3	5	of bedding planes.		$\  \cdot \ $						4	
						3	-	(4)										
5-1						,	2	3	Partially gravelly cores.	$\vdash$	1	-		╀	<del> </del>	Н	-5	
4					^		5	5	Small solusion cavities along calcite veins.								ı.h.	ŀ
6	<u>a</u>				grey		3	2	giong edicite venis.			ľ			l		6	,
=	Shal						3	4	•		10.							
7					Dark	-	2	3			"=						7	
8-1						1.	3	4	28.0					ŀ			8	
"]						2	2	3 5										İ
9		2550	<b>##</b>			3	_	2	29.15						·		9	i
1 4									29.15 - 70.0 <sup>m</sup>									. ]
30									Obtained only cuttings.								- 30	
न									All cuttings are black									
1									and non-calcareous.		-						1	
2 -																		
13														1				
3 -																	-3	
	- 1									1.								
4 =	_	$\left  - \right $									<b>∳</b>						4	
-										$\perp$	ΐ			$\vdash$	1	Н		
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8 =																	-8	
4						.											- 1	.]
9-						ļ			·								9	
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<u>,</u>		ľ	7 1			1	T	1	> driller's note 4								· · · ·	
		Ĭ.	俗图	core los-					tick) 2 (substick) 3 (piece), 4 (fragment), 5 grain	•								
			<u></u>	core loss		T Figh			5 (soft) compased)									
		ŀ	1	cuttings								EI	ECTRIC	PO!	VER :	DEV	ELOPME	NT CO., LTD.
		ſ	<i>:</i>	entitila					- 7 -						TOK	YO. J	IAPAN	

ANG	RDII LE	NATE FROM	A HORI	CEMENTAL DEL SENDE SENDE SENDE SENDE CASING	75 l	58.2 90 	E •	LE TO CO	PTH OF OVERBURDEN  NGTH OF ROCK DRILLING 7  TAL LENGTH OF CORE  IRE RECOVERY 2  ERVATION OF CORE  DESCRIPTION	0. ( ).3·	0 m 4 m 2 % WATE	C D L(	OMPI RILLE OGGE	LET DEDE	ED 3Y 3Y	Apr2 ROE M.Shil	
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<b>1</b>								-	Obtained only cuttings. All cuttings are black							مانتشانسان	
3-1					: '	***			and non~calcareous.							2 3 3	
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5 6							-				K=1.10		-			5 1000 1000 1000 1000 1000 1000 1000 10	-
7 minutes																րապահասիր 1	
6 8											4-01×					9 9 9	
50 day	le )				(Black)						K=1.72					50	
2-1	(Black shale				<u>(8)</u>											-2 2	
3 41	Œ)										×10-4					3	
5											-\ <u>#</u>					5	
6-											又					EL 6	
8							mark to the				5 x 10-4					8	
9											K=7.23					60	126.6
		į		core lass					▶ driller's note 4.  lick). 2 (substick). 3 (piece). 4 (fragment). 5 grai.  5 (solt)	n			. 1	***	 		



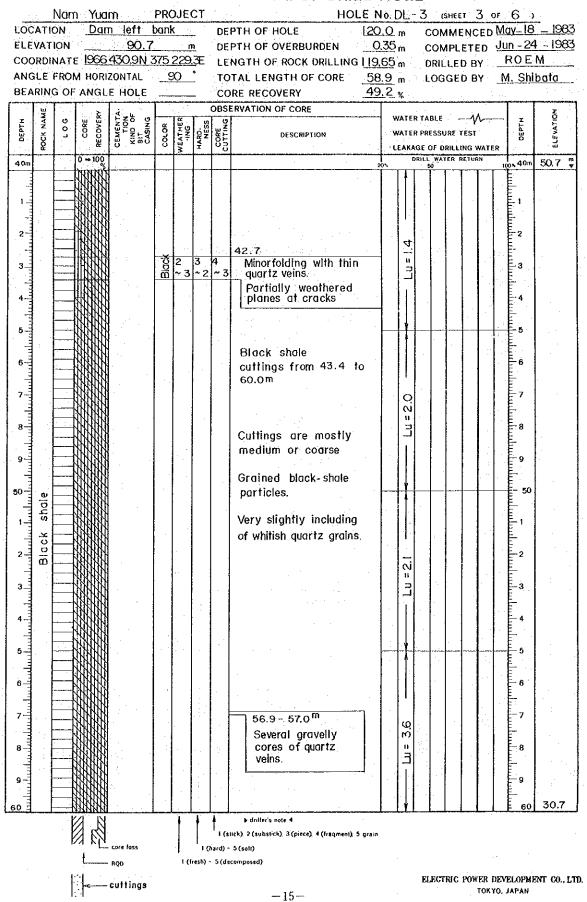
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•												P	age
•					AIC LOG OF DRILL							·	
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	<u> </u>			OBS	ERVATION OF CORE	Γ		BAT S		4.4			3
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Om .			+		Topsoil and talus deposits.	, 		- 50	_			1000	,,,,, <u>*</u>
					(Some gravel and soil)		-					E 1	
den Gen		Ē										ամա	
Over burden		Brown						1				2	
3 O Vegr (2)					3.2							3	
		grey			Weathered black shale								
4 15		brownish grey	-	4	mostly flaky and brittle							<u> </u>	4
5_	7777	Brown ~ brown	4	3	cores.		1	1		-	_	- 5	
		<u></u>			5.8							E 6	
6 3		3		3	Weathered along cracks								
7-	777	-	(4)	(4)	and some of bedding		ω	•				E 7	
			3	3	planes, but most of cores are 15~20 <sup>cm</sup> long.		u=4				-	. Line 8	
8		2	\$	5	die 10° 20° long.								
9-			2	2								E 9	
10-		}	2	2	•		3					10	
		3	3	3									
			2	2									
shale		finin bands	3	3	Clay seam at 12.7 m		5					2	
~ ~ _ <sub>• 7</sub> или		_ <u>ē</u> 3	3	3 ~4	Cracky and weathered		4 =						
Black %		e e	3	3	13.5		_ Lu					- 3	
4-		9			Generally fresh,					* 7		4	
		ğ			partially weathered along cracks.								
5-		SII S	2	2	Some small solution	П							
6 9 9		partially	5	3	cavities along bedding planes (calcite veins along							6	
					bedding planes )	0						7	
		Black	(3)	(3)		<del>-</del>					٠		
8   60-					koje dispersor in la 1991. In dispersor	4.52						E-8	
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	core loss		1	. 1	tick), 2 (substick), 3 (piece), 4 (fragment), 5 grain - 5 (soft)	• .							
L	RQD				camposed)		4						
	cuttings				-10-			EL	ECTRIC			DEVELOPM (O. JAPAN	ENT CO., LTD
		14.74			-10-	77							

Nam Yuc	ım {			U	HOLE N			er 2 o	or 3∵ )	
	n left ban			DE		0.0 m	COMM	ENCED	May _ l	1983
ELEVATION				DE	PTH OF OVERBURDEN	3.2 m	СОМР	LETED	<u> May - 14</u>	-1983
COORDINATE 1966		<u> 5 194</u>	HE	LE	NGTH OF ROCK DRILLING 5	6.8 <sub>m</sub>			ROE	
ANGLE FROM HOR		90		TC	TAL LENGTH OF CORE 5	3.8 m	LOGGI	D BY	M. Shi	pata
BEARING OF ANGL	E HOLE			CC	RE RECOVERY 9	4.7%				
MA E	4 X 7 0	. 100			ERVATION OF CORE	WATER	R TABLE	<b>1</b> \		ĕ
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				3	Generally crocky and					
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2 20		3	3	(4)					· E.	
				-	Parlially black shale	9			-2	
3.		1	5		changes into pale gray	×			3	
					due to weathering.	ß			. 📑	
	}	(4	) (4)	4		9=				
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39	1	-	+-	-		1			E 3	•
		3	3	3	Partially pale gray					
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		(5	) (2)	2	27.7	6.4		1	[7]	
		" <u> </u>	+		27.7	5				
		bond		_	Some longitudinal cracks				8	.
9				3	sustained by oxidation					
		grey 3	3	3	and solusion.				F 9	i
30		0			(with small cavities)					
		ğ		(4)		1			30	
Black shall		<u>- L</u>			31.0				E.	·
3 3 3		티	Τ'		Generally somewhat				`E'	
Trumple Black		<u>≥</u>	3	2	cracky. All planes of					
		partially	1	1	cracks are sustained	9			E-2	
3	ľ	ğ			by oxidation.	, ii				
			2	3					3	
13 15		Black,	3	4			1			
		CO	1 .		Partially weathered		i		-	
		3	3	3	(reddish brown) cracks.		li			
		] 3	,	,	(Toddion brown) cracks.					
8			2	2						
	. [				Black clayey material				- 6	
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7 35			3		•	[ ]			[ 7 ]	
						M				
8		İ	3	3	to at the control of	7			E-8	
	-2°				Partially small solusion					
1° 3 32 3 11			(2)		cavities along calcite				- 9	
40 7		.			veins.				40	111.1
N N		1	4	•	> draffer s note ◆			LL.		
				1 (51	ck) 2 (substick) 3 (piece) 4 (fragment) 5 grain					
1 1	caré loss	1	ÍΙΩ	ard) -	5 (soft)					
<u> </u>	RQO	,	(fresh` -	5 (dec	omposed)				•	
	cuttings						ELECTRIC			VT CO., LTD.
1 i	-				11-			TOXY	) JAPAN	

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					E HOLE		<del></del>			TAL LENGTH OF CORE 53 PRE RECOVERY 94	1.7		L	.OGC	3ED	BY	M.Shi	bata
1			Π	······································	<u>.                                      </u>	T		-		ERVATION OF CORE	<del>;;</del> -	- %			·	<del></del>		
	рертн	ROCK NAME	0	CCRE	CEMENTA TION KIND OF BIT CASING	K	H O	8	υŽ		•		AT R		55	₩-	ОЕРТН	ELEVATION
	ä	Ď.	۱ ۱	REC	CEMEN TIC KIND BIT CASIN	COLOR	WEATHER	HARD.	CORE	DESCRIPTION	ł	·		ESSUE OF DR	30.00	<ul><li>10.0</li></ul>		S.L.F.V
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١	1-		-,-	ЩШ				3	3		1					1		
	أينطب		2		1					Less weathering along cracks or bedding planes				l			[	
	2-			111				\$	3	below 40.7 m		0					2	
								2	(2)			4						
	3-1			73				-	127	Partially cross joints with calcite veins.		٦					E 3	
	4						2	-	- 4	<u> </u>		ĪĪ				1		
	, ,			111111				3	o~4	Slightly sheared					- [.		[ 4	
-	5		30					3	3	Partially gravelly cores,		<u> </u>				1	E <sub>5</sub>	
	1						} }	S	ţ	but less weathering.		1		ŀ				
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	8	ļ										= 5						
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	9-	ŀ			ļ	Ö		١	ς.	48.8 <sup>m</sup> . Slightly disturbed							والا	
Ì	20-11						- ]	- '	,	around quartz veins.								
	50-	w	-4		, .			2	(2)	, , , ,	<u> </u>	ļ.		-	-	-	- 50	
	بالساسياسيان	shale					ŀ											
	17						İ			Partially gravelly cores,						1		
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	4				·		.		4								Ë 4	1
ŀ			55															
	,   							3	2	Rather clear pale grey		1	7		-		5	
	6-3							2	3	thin bands at 55.0°°, 56.0°°						١	E .	
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	<u>,                                    </u>	ري او				중				Black shale (?)								
	" ]	Sha				Black				Non calcareous.							9	
6	0 10	<u> </u>	<u>—</u> 1)	MM		$\perp$	1	$\perp$				1					60	91.1
									l (stu	b driller's note 4 (k) 2 (substick): 3 (piece), 4 (fragment), 5 grain	:					5 		•
÷		. 1.	1/2	,   121/4	ore loss		1	j j (ha		(soft)								
K.		in James	1	L	8 <b>Q</b> D		1 (fr	:sh) ~	S (dec	omposed)								
				C	agnittu								ELE	CTRI			DEVELOPME (Ö. JAPAN	NT CO., LTD.
										-12-						. UN 1	JAFAN	

	١	lam	Yuar	'n	PRO	OJE	OT.		HOL					·. (S	HEE	T	la	OF.	6 · )		
	CATION <u>Dam left bank</u> EVATION <u>90.7</u> n							DE	PTH OF HOLE	120										1983	!
									PTH OF OVERBURDEN	0	35	m	C	Ю	PL	ETE	Ð	Jur	1 - 24	1 - 1983	
								LE	NGTH OF ROCK DRILLING	119	<u>65</u>	m	D	RIL	LE	В	Υ			<u>M</u>	
			100	ZONTAL		<del>90</del>	• •	5.75	TAL LENGTH OF CORE				· .L	OG	GE:	DΒ	Υ		l. Shi	bata	
BEA	RIN	G OF	ANGL	E HOLE					RE RECOVERY	49	.2	%								·	
	*ME	ڻ	. χ. 	¥ Z do U	<u> </u>	īα	Y		ERVATION OF CORE		v	VATE	R TA	BLE		1/	<u>.</u>		,	Š	1
DEPTH	POCK NAME	٥	CORE	CEMENT, TION KIND OF BIT CASING	COLOR	WEATHER-ING	HARD.	CORE	DESCRIPTION					ESSU		•	•		БЕРТН	ELEVATION	ŀ
	§.			n × a∩	8	<u>×</u>	₹ :	85			Ĺ			OF DR				R		3	
Om		<b> </b>	0 → 100								0.	,	DRILL	WATE	ER 6	ETUR	N.	100	Om	90.7	
	<u> </u>		<b>/</b>						0.35 Topsoil, dark brow	<u>n</u>	ŀ							Ì			
1				}		3	3	3	Weathered black shale. Cracky and weathered		ŀ		1				. 1		- 1		
				} •	black	3	2	4	along cracks.										_		
2	'	$\vdash$				-	-	7	Cassas				1						-2		
-			111111		<b>→</b>		- :	- 1	Cuttings										_		
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			AIIIS		ish	3	3.	5	along calcite veins.			] .							-		
4-			MIIN		Brownish		2	(4)											<b>-∙4</b>		
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5									Bedding planes not so				. :						-5		
			###				2	2	obvious. Sound shale										-		
6-3		}{	###			3	3	\$	but weathered along										-6		
- Action		H						3	cracks.										-		
7-3							3			•									7		
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8-	- 1	~~			Black	3	3 ~4	3 5		_									- 8		
9-3					æ		3		Sheared and black sof			4									
1 "11	a)					3	ζ,	3	materials at 8.3 - 8.5 <sup>m</sup>			Ω×							- 9		
10-3	shale	20					2	Ŭ			_	7.43 x			_				- 10		
The state of		"						2	Sheared and black soft	'n	j.	<b>小</b>					·		-		
1-	a <sub>ck</sub>	-~				3	<u>~4</u>	3 ~(5)		.,	1	<u> </u>	_^	M		-	-		-1		
ulu	ā	-	MM						11.0 - 20.0 <sup>m</sup>				G.I	<b>/</b>	Оц	١	-5.		-		
2-3					-				Cuttings. Cutting materials are		4-0								-2		
-									mostly medium or coar	se	Σ×								- 1		
3-			MM	,					grained rock fragments		64								-3		
				:					of black shale.		2								-		
4-1											X			. [			.		4.		
				:					(No reaction with acid	)					.				_		
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9-3							1						-5.54×10						-9		Ì
			MM		٠.	ŀ			•		$\  \ $		ij							70.7	
[ 20 ]					1	<u> </u>	▶ driller's note 4		للسل	للبا	포			!		£	20	70.7	J		
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	TION		left b			-,) <sup>*</sup>		PTH OF HOLE 120								3 <u>1983</u>
								PTH OF OVERBURDEN CONTROL OF ROCK DRILLING 119	1.50	, m						4 - 1983 M
			ZONTAL		90										ROE	
			E HOLE	~~~		7, 1,	00	TAL LENGTH OF CORE 56 PRE RECOVERY 49	1.2	m		JGGE	UE	3 Y	M. 5111	0010
<u></u>	<del></del>	MINGL	LIIOLE				-	ERVATION OF CORE	. <u> </u>	*						
r	NAME O G	CORE	¥×ö ç	-	<u> </u>				١,	WATE	RTAB	E	٠١	۸	<u>r</u>	, <u>v</u>
н Те	N OCK	CORE	CEMENTA TION KIND OF BIT CASING	COLOR	WEATHER -ING	HARD.	CORE	DESCRIPTION	,	WATE	R PRES	SURE	TEST	1	DEPT	ELEVATION
			S & #0	ŏ	₹	Ĩ.	ŏä			-	AGE OF					<u> </u>
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		MMM		Black)											luul.	
2-3		mM		3)						0					2	
					<u> </u>	<u>_</u>		Weathered cracks,		×		ľ			_ E *	
3_	10°_			용	2	2	3	Somewhat brittle bedding		9		1			<u> </u>	
]				8	3	3	4	Somewhat brittle, bedding planes are not so clear.		100						
[ <sub>4</sub> ]						-		Cuttings		~						
				٠		<u> </u>		Black gravelish cores								
5 3				Biock	2	_	4	slightly weathered along	╢							
"]	i			ă.	3	3	3	cracks.	П							
6-3	K															
"]		MM						Black cuttings.							6	
7-3	$\vdash$	WW		-						Q Q		-			-	j
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8				Blac						35			1		[m]	·
"				<u></u>						27					8	. 1
	2	m								×			1		Je i	
"]					2~3	3	4	Small gravelly							اسلا	
30	- [-							cores some cores with weathered	ļ						E- 30	.
1 - 1		MW		ack				colour.						1.5	3	
1 3 9				핆	:											·
ulundundu eleda	į 🗔			<i>-</i>									١.			
2-3		WW.		32	2	3	4	With some quartz veins							E.2	
3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				m	~ 3	_	~3	gravelly cores		28						. [
3 1 6	<u> </u>	MM						Cuttings of black shale.		3					E.a	
		M		풇	2 ~ 3	3	4 7	Minorfoldings observable.		1-1						
4 =		樅Щ	· ·		Ť			33.7 - 40.0 <sup>m</sup>				1			E <sub>4</sub>	
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40 1		иии								Ш					40	50.7
	V	K.			1		†	▶ driller's note 4								
	1	1/1 K	core loss				900	ck) 2 (substick) 3 (piece) 4 (fragment) 5 grain								
		1	ROD		10			5 (sofi) omposed)								
	od Desira	4								- 1	ei ez	andic.	unw	ro n	EUD ANUP	NT CO., LTD.
		· / '	cuttings:	11				<b>— 1</b> 4 —			14141				O. JAPAN	era vera dilla
4.0	100		and the second second	1.7				172								



Nam Yuc		ROJE	CT		NO. DL=3 (SHEET 4 OF 6 )
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COORDINATE 1966	90.7 34309N 3	75 229.3		EPTH OF OVERBURDEN <u>.C</u> ENGTH OF ROCK DRILLING <u>119</u>	0.35 m COMPLETED Jun - 24 - 1983
ANGLE FROM HOR		90			39 m LOGGED BY M.Shibata
BEARING OF ANGI	E HOLE		_ C		0.2 %
T A MR	A ZP O	····   œ		SERVATION OF CORE	WATER TABLE V I
DEPTH CCK NAME LOG CORE	CEMENTA. TION KIND OF BIT CASING	COLOR WEATHER	MARO. NESS	DESCRIPTION	WATER PRESSURE TEST
h		ğ ş	ž č		CEARAGE OF DRICEING WATER
60m NXXX	<b>}</b>			Cuttings	20. ORILL WAYER RETURN 100.60m 30.7 T
	1	(Black)		Currings	
		ĕ			
		<del>3</del> 2 <b>2</b> 2 3		Disability of about	
	X 1		3 4	Black shale, slightly weathered along cracks.	
Veij Fr€		ack)		Only gravelly cores.	
	{	<u>@</u>   :		Cuttings	
1 1 3 2 1		ejij 2 XX (	1 3	· · · · · · · · · · · · · · · · · · ·	1
[ ]		500 3	3 4	and gravelly black shale.	
	g E	DO -		Cuttings	1
6-3				outtings .	
	\	(Black)			
7		<u>.</u>		67.5	-7
		2	3 5	Generally gravelly cores.	
shale		3	3	Minorfolding with thin	
2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and 2 and				Cuttings quartz veins.	
			•		
70		2	4	Partially weathered	70
		3	3 5	along cracks.	
2-1		2~3	3 4	Cuttings	
2		273	4	Cuttings	M = 2
		2	3 ~	72.8	
3-	vhite	3	2 2 3	Somewhat long cares are recovered.	
4 <u>5</u>	<u>≯</u>		3 3	Cuttings	
	did				
Ouartz vein	Sign Asia	.3	3 4	Cuttings Mostly gravelly	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 3 (===      <u>1</u>		3	1~3 3.		
6-1-1-1-1		3	3	Calc shate, bedding planes	-
7 (0) 20			3 5	are not so clear.	
shale		g 2	4	Partially flaky	
		nish 	3-44-	Sheared at 77,95~ 78.3 <sup>m</sup>	
Calcareous		Whity greenish grey	3 2	Somewhat whitish (whitish	
9   8   1		ا کا ایک	3 5	means rather calcareous)	
80 35		<b>§</b> 3	2 3		80 10.7
		1	1	> driller's note 4 (stick) 2 (substick) 3 (piece) 4 (fragment) 5 grain	
Z1 KN	– core loss		1 .	- 5 (solt)	
<u> </u>	- AQD	1 (1	esh) ~ 5 (	lecomposed)	
	-cuitings				ELECTRIC POWER DEVELOPMENT CO., LTD TOKYO, JAPAN
1.7				<b>-16</b> -	

. Nam Yuar			ECT		HOLE N							
	left bo				· ·	0.0		сомм	ENC	ЕОМ	ay _ 18	_1983
ELEVATION COORDINATE 19664	90.7 1309N 37	75.22			PTH OF OVERBURDEN <u>O</u> NGTH OF ROCK DRILLING <u>119</u>	).35,					n - Z <sup>z</sup> ROE	1 <u>- 1983</u> M
ANGLE FROM HORIZ			)		· ·	ا 39 احمد		DRILLE			vi. Shi	
BEARING OF ANGLI	E HOLE			CO		9. 2						
A AME	TA. N OF G	16			RVATION OF CORE	l w	ATER	ABL F				ž
DEPTH COCK NAME LOG CORE RECOVERY	CEMENTA TION KIND OF BIT CASING	COLOR	-ING HARD-	CORE	DESCRIPTION	1		RESSURE	TEST	,	рертн	ELEVATION
	2 2 20	Ö g	]	89		LE		E OF DRILL		-		
90m		-	+	-		201	11	LL WATER	RETUR:	· T	100 8 0m	10.7 🏶
			3	2	Partially slightly sheared and slightly flaky.							
		grey		]	diz ditgility trans					-	ևահա	
2	ĺ		۶   ۶	5			,				due.	
		Whity greenlsh		(3)			0.2				F 3	
3-		) gre	2	(3)			<u> </u>				E 3	
		E E					1				ш	
4-	·	<del>-</del>				1 1					4	
					Rock color gradually change		V					
	.		3	2	rather pale greenish.	П		TI			5	
4 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -			S	5	The more greenish the less					.   .	Ē 6	
				,_,	calcareous.							
7 3			2	(3)			9.0				E-7	
8-3							) <u>=</u>				Ē.	
			3	3	Generally sheared		Ī				8	
9			\$	\$	partially clayey.						E 9	
ale i			(4)	(4)								
shalk			4	4	Sheared part	$\vdash$	+		-	+	90	
Sus Light		و ا	3		Siedied part						Ē.	
Caicareous		green	1(4)	3	Charad nack		ŀ					*
2 8 7 7		- 1	3	4 4 (3)	Sheared part						2	
		light		(3)	Most of cores are broken into small pieces.		_					
3-		ا ۾	3	3 1 2	and omen proces.		3				3	
		greyis	3	4	•							
			5	5	Sheared at 94.5 m							
5 1		Pale	(4)		Pale greenish clay at 95.6 <sup>m</sup>	<u></u>		++			5	
6 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minum 7 minu		_			rate greenisticity of 90.0"		1					1
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			4	4 ~3	Somewhat sheared at 96.9 - 97.4 <sup>m</sup>		 (5)				[7]	
8			3	2			= 7				8	
			2	3			]					
9											-9	
100			3	3			$\  \ $				100	-10.7
IL N		1	1	†	> driller's note ◀	-,						
图 段	core loss		10		ick), 2 (substick), 3 (piece), 4 (fragment), 5 grain 5 (soft)							
1	RQD				ompased)							
·   · ·	cuttings						I	LECTRIC				NT CO., LTD.
j.					17				T	υ <b>ΚΥΟ</b> .	JAPAN	

				ım					HOLE	No.	DL.	- 3					
	VAT	ON	uan	1 leff   90.7	banı	<u> </u>				0.0							3_1983
					375	229	<u>"</u> 3E	UE	PTH OF OVERBURDEN <u>C</u> NGTH OF ROCK DRILLING <u>H</u>	), <u>33</u>	m	- CO				ROE	4 -1983 M
ANO	GLE	FROM	HORI	ZONTAL		90	•									M. Shit	
BEA	RIN	G OF	ANGL	E HOLE			_ /			9,2					-	0	<del>,,,,,</del>
	¥E		ò:	d _ u .					RVATION OF CORE	T							ž
рертн	ROCK NAME	0 0 0	CORE	CEMENTA. TION KIND OF BIT CASING	COLOR	E S	HARD.	CORE	provinción (	Ι.		R TAB R PRES			* * 1	Бертн	ELEVATION
۵	õ		, A	유 출발인	8	WEA.	ă z	85	DESCRIPTION			GE OF			1		13
100m			0 ⊶ 100							20%		RILL 50				100 \100m	10.7 🚆
1					Ī		3	3			П	Ī	$\top$		T		
		20					3 ~2	3 ~ 2					-	1	-	E	
1	919				green		45	4-5	Sheared at 101.2 ~ 101.4 m							l E'	
2-	shale						3	2		]						E 2	
	SI				pale -	2	,	5			w	i				<u> </u>	
3-	Calcareous				ă		2	3			11					E 3	
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4-	ပိ		1		Greyish		4~3	4				Ì	-			4	
=		$\boxtimes$					A -9		Core loss at 104.3-104.7m						l	<u> </u>	
5 = 1				-			4-3	4				$\dashv$		+-	-	<u>E</u> -6	
1 1					8				Generally samewhat							nipin	
6-3					green		3	3	flaky:							6	
		191			1 1											1	
7-1	1				pale.		4	3	Reconsolidated		27					E-7	ļ
1 3	Ì				Greyish		3.	$\rightarrow$	sheared zone	1	11						
"=					Sre		3	4 3	Flaky cores.		ᅴ					8	-
8 0 ulumlumlum									Somewhat whitish and							E 9	
=					ish		2	2	slightly massive clay							11.	e e
110-					ee >		١	s	seam at 111.4 m		¥	_		.			
					y greenish grey		.	,,,				ĺ				-	
1-					Whity		3	(3)				İ		]		F-1	
السلسلاسلاسلاسلاسلاسا	. ]				=		3	3	C1			.					* .
2-	s shale	00				2	-		Clay seam at 111.7 <sup>m</sup> and 111.9 <sup>m</sup>		4					E 2	
	S						2	3	Generally fresh slightly		위	1				E	
	- 33 1				•		5		exfoliative along bedding		3					3	
<b>[</b> [	Je l	lid		· · · :		.	3	2	planes.	ŀ							
]	Calcarea					.	1	۲								<b>E</b> 4	
5-1	O		1111111			- }	_		Clay seam at 114.7 m			$\perp$	<u>.                                    </u>			_ [	
					c		2	2	oray scam at man		11	٠ .		**			
6		10°			green		3	5	Somewhat clayey at 116.0 <sup>m</sup>	>						E, 1	
4	-				- 11		3	(3)	outemat cityey ti 116.0		11		İ			` <u>`</u> [_"	
7-	-				de		,				60						
	Į.			, : I	2	, t	5~2	3			ol						• ]
8-					Greyish pale		_				4					8	
] =	-				Gre		· 1	2	:		-		1		ì	<u> </u>	
9-	1						5	<u>'</u>								9	2 4
120	3	91					3	3									-30.7
<u></u>	!1	ши [/]	N			<u>↓</u> ∤	<b>—</b>	<del>- 1</del>	→ driller's note 4				ــــــــــــــــــــــــــــــــــــــ			<u>  [120]</u>	-30.7
			[3]					1 (stic	k). 2 (substick). 3 (piece). 4 (fragment). 5 grain								
				care loss		1 25		(d) - 5					٠.	٠			
		154		RQD		Gre	an) 🤝	- fasco	mposed)	"		De Co	Marie -	110-1	. 10		:
			<del>&lt;</del> 0	uttings				•	<b>—18</b> —			ELEC	THIC			EVELOPME: D. Japan	vi co., lid.
				4.5	1000				10								

	LÓC	Na ATIO		Yuam Dam	left b	PRO		СТ	ŊF	HOLE N								3 <u>1983</u>
			ION		191.4			<u>n</u> .		PTH OF OVERBURDEN				MPL	ETE	ED ED	Aug 2	2 -1983
	- 1				774.5N 3					NGTH OF ROCK DRILLING 78				ILLE			ROE	
					ZONTAL	_ <u>c</u>	<u>x</u>	-		TAL LENGTH OF CORE 77			LO	GĞE	DВ	Υ	M.Sh	bata
	BEA		i Or	ANGL	E HOLE	T				PRE RECOVERY 98		%			<u></u>		<del></del>	<del></del>
	Ξ	ROCK NAME	U	RE VERY	F SO 5	~	8	1 92		ERVATION OF CORE	١.	WATE	RTABL	€ -	\ \psi	٧	<sub></sub>	NO.
	ОЕРТН	SCK 1	0	CORE	CEMENTA TION KIND OF BIT CASING	0,00	WEATHER	S S	CUTTING	DESCRIPTION	1		R PRESS	100			- DEPTH	ELEVATION
	Om	æ		0 → 100		-	3		00				AGE OF					
i	-								<del>                                     </del>	Lateritic soil.	à\ 		50				100 Om	191.4 🖫
	1	Over - burden	Δ		al de	adis Seps			ļ	Luterine soil.								
	1-	<u>88</u>	Δ			<u>6</u> .5				1.5							<u>-</u> 1	
	2								3	Dark grey, slightly impure			.				2	
	1		干						2	Ls. Massive no bedding		0.0					Ē.	
	3-								3	plane. All cracks sustained by	l	3					_3	
	=									oxidation (reddish brown).		-						
	4-1		<u></u>			(sy			2	No solusion cavities or							E-4	:
		- }				cracks)		-		fissures.		İ↓					<u> </u>	
ı	2,-1				. :							-		<u> </u>				
	6-3	•				o f		İ	2	Partilly core loss.						i I	E 6	
	1		!			planes			,	e e e								
ı	7-						2	1	3			_					E 7	
-			中			ţ			,			o						
	8-	imestone				brown						3					-8	
		est	ĊЦ.			1	. \$	5	2									
	9		ф.			Reddish				95	ŀ						9	
	10-3					8	3	2		Longitudinal crack with		1					10	
-	``_	. [			1		Ĭ			rough planes (reddish brown)		11					E	
-	1-	:	-4			grey				at 10.4 <sup>m</sup> - 10.8 <sup>m</sup>			.				Ę.,	
		-								Thin solusion fissure								
-	2-					Dark	:		2	at 11.2 <sup>m</sup> -11.3 <sup>m</sup> , 11.3 <sup>m</sup> -11.4 <sup>m</sup> and 11.8 <sup>m</sup> -12.0 <sup>m</sup>		W					2	
	~ <del>-</del>	ľ			1. 1							0					· <u>E</u> ~	
	3-4	ľ			j	Ì			3	All cracks sustained by		Ė					-3	
	4	ľ	Τ',			ŀ				oxidation .								
1	-1	H					Ì										للسنا	
	5-	.	$\mathbf{I}_{i}^{H}$		· .				3					-	_	-	5	
	4	Ц			j	ľ												·
	6-3		_4		ŀ				ŀ	_16.0			ļ				E-6	
ı	- 1					Vein				0							L.	
1	7	oue .				Ę.	ı		İ	Solusion fissur at 16.8 <sup>m</sup> -17.0 <sup>m</sup>		0.3					1 7	
	8-	limestone	H			3						3					8	
	and.	<u>.</u>				¥.	3	_				-						
	9-1	اج	H.			976	3	2	3	Cracky at 18.5 <sup>m</sup> - 18.6 <sup>m</sup>			.				9	
-	20	Sandy	ΙΉ		.	24	1	. 1	(4)	Reddish clay at 19.3 <sup>m</sup>							F.	171.4
٤		1.	<u>. rı</u>	anulli A		<u> </u>	1	l	1	▶ driller's note 4		للا					<u>‡ 20</u>	.,,,,,,
					cara lee-					ick), 2 (substick), 3 (piece), 4 (fragment), 5 grain								
				1	core loss RQD		  -1 (fr			5 (soft) composed)								
			ŀ	4					•				ELECT	TRIC 1	Wo	er di	EVELOPME	NT CO., LTD.
				.le	cuttings					<b>-19</b> -							). JAPAN	

Nam	Yuan	n	**		CT		HOLE N			1	SHEI	FY 1	2	or A	,
LOCATION		n left	ban				PTH OF HOLE 80	O_m		CON	ИΜ	EN(	=	Jul 2	<u>,</u> 3_1983
ELEVATION		191.4			<u>m</u>		PTH OF OVERBURDEN 1	.5 m	· (	CON	ИPL	ĒΤ	ED	Aug -2	2 -1983
COORDINAT					_	LE	NGTH OF ROCK DRILLING 78	1.5 m		ÓRIL	LE	D E	3γ:	ROE	M
ANGLE FRO				90	_	-		<u>O</u> m		LOG	GE	D E	βY	M. St	ilbata
BEARING OF	ANGL	E HOLE	γ					1_%							<del></del>
DEPTH ROCK NAME LOG	, k	F X S S	-	Te	1 6		ERVATION OF CORE	WAT	ER T	OLE		1	۸		Š
CK NAI	CORE	CEMENTA TION KIND OF BIT CASING	COLOR	WEATHER .	HARD.	CORE	DESCRIPTION	WAT	ER PE	ESSI	JRE '	TEST		ОЕРТН	ELEVATO
}	0 <b>→</b> 100	0 100	ļ.	Įž.	È	03		LEAR	AGE					R	
20m	MATERIAL STATES		- <u>-</u>	ļ	<u> </u>	<u> </u>		1 105	ORILI	₩A 50	TES	RETU	RN T	100 × 20m	171.4 🖫
			prown	3	2	2	Slightly soluble along most of cracks.	1	1					<b>E</b> .	
limestone			i tsi						1			-		Ē.1	
		. ;	198	1	3	}	Slightly distubed and brittle at 21.5 m	'	İ					<u> </u>	]
1 2 3 5 1 1			ν. ÖΣ	2	3	3	Driffe of 21.5"	α	<u> </u>					2	
Sandy			Sor	۔ ا	3	3	23.0	11		İ	[-			Ē	
3   "   [ 1			1		3	3	Slightly brecciated and	=	3	l				<u>-</u> 3	
			brown		-	- '	reconsolidated limestone,								
imestone			ā	3	5	\$	partially cracky and brittle							E 4	:
5 5 5			ig.		2	(4)	25.1								
			-	-			Somewhat weathered		Π					E°	
6-3			brownish	3	3	3	breccia (inclusions of sandy							Ē 8	
1 380	##		§	5	5	5	and shaly breccias ).							Ē	
7 3 3 3							Partially small solusion cavities. Slightly brittle							E 7	
1881	## III		ight g	(4)	(4)	(4)	as a whole.	0	!					<u>E</u>	
8 8 1	1111						28.1	11						E 8.	
						2	Calcareous shale with	-	4 -					Ę.	
9-	##						sandy part. Somewhat calcareous as							9	:
						3	a whole.					·		1	
30 159	排	:				٠,٠	Partially small solution		-		$\dashv$			30	
Tage transfer	和		ارة ارة		3		cavities along bedding							<u> </u>	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			ъ			(2)	planes.							<b>E</b> 1	
Apubs 1			eenish	3		2	Sheared and brownish	'			١			2	
אווא וב ו			lee.	٦	5	5	clay at 32.5m	0						E'	:
with			. gr			(3)		11						E_3	
1 1 1 11			₹			ľ	Partially flaky					. [			
4 3 8 397			vish		2	3	(at shaly part)				•	٠.		4	
La Si		4	yellowish	1		-5									
Treous sandstone Colcoreous shale					:	(2)			Н		$\dashv$			<u></u> 5	
			ight		- 1	(2) 4	Cracky and weathered	-							
						~	along cracks. 36.5							E 8	
				$\dashv$			Very slightly calcareous								
7 5			>	2	2		medium grained soundstone	7						7	
Cdicareous sandstone			grey	-3. 1 -3. 1			partially shaly in bands.	0=1							
			~ dark	3	5	5	Dustially	Lu						F-8	
			ď				Partially cracky.								
			Grey	3	3	3					:			9	
40 18 11			ত					1		$\perp$		$\perp$		40	151.4
			7				driller's note 4								
K	111	core loss	· · · · .		100		ck), 2 (substick), 3 (piece), 4 (fragment), 5 grain 5 (soft)					10			
	<u>t</u>	RQD		ı Çi		· ·	amposed)					•			•
	1	ultings							ELI	ести	uc i	OWE	R D	EVELOPME	NT CO., LTD.
	f						-20-			***		Ť	OKYO	O. JAPAN	

Page

				1 1000			CT		HOLE N										
	OCATI			1 left b 191.4		r			· · · · · · · · · · · · · · · · · · ·	00									<u>  1983</u>   1983
				774.5N 3						1. <u>5</u> 3.5			RIL						<u>- 1983</u> M
				ZONTAL		90	_	-		7. 0			OG						ata
В	EARIN	G OF	ANGL	E HOLE					re recovery 98	<u> 8. I</u>								1 . s.	
Γ.	NAME	U.		A NO A		l Ox		<del>`                                      </del>	RVATION OF CORE	V	VATE	R TA	BLE	_	:. 4/	\			ž
į	SOCK N	0	CORE	CEMENTA TION KIND OF BIT CASING	COLOR	WEATHER	HARD.	CORE	DESCRIPTION	1			ESSU	RE T	EST		- Hidde		ELEVATION
	8		0 <b>→</b> 100	Ö × mO	ŏ	3	ř	8			~~~		DE DE				R		
4	Drna 	<del> </del>	annañ T	1 2		-		1	Gradually changes.	20-		1	,		- 10.0		100 4	Ont	151.4 🛱
	4	ρġγ						2	Limestone banded with										
		$H \vdash$						2	a few greenish shale.					Į			E 1		
	.]	H						3									E,		
'		H +			<u>ש</u>				Partially rather massive.		4.				·		- [ ]		.
3	1	H			pand		٠,		Slightly weathered along	-	E E		$\dashv$	M			_ <u> </u> 3		
	4	H H			thin			2	cracks.		]_]		G.	.	43	οη			
4	il e	Н														.	1 ₽		
	ռաևումուսև _imestone	HH		٠.	eenish		2	5									Ē.		
'	Ē	Н			ģ	. :											ǰ		
6	 	НН			pale		\$	l l	•								-6		.
	Shaly	Н			with				Small solusion cavities							•	F		
7	1			.*			١.	2	at 46.9 <sup>m</sup> , 47.8 <sup>m</sup>		Ю.			1			E-7	1	.
1.	1	1			grey		1	3			0								
8	]				<u>≥</u>			7			3						F 8	1	
9	1				Whity	2		3									Ę,		
	<del>-</del>	 					-	3	49.5 <sup>m</sup>										
50	4							\$	Gradually changes slightly calcareous	-			-	$\dashv$	-			50	
1.	and for				_	: :		(2)	sandstone (fine grained)								E.		
'	T See				grey		·	3	massive.						:		E'	1	
2	Calcareous		##		Light						'						E_2		
	8_	11			<u>`</u>			5	<u>5</u> 2.5		ς.								
3	4							2	Gradually changes Limestone banded with		0=n_						- <u>E</u> -3		
	1						-	2	calcareous shale.										
4	-								Most of cores broken							.	<b>F</b> 4	1	:
5	] .			.4			. :	5	along their bands.	Ĺ.		- 1					E,		
	1 6							(1)											
6	Limestone								Como oracka with								E a		
	ΞË	1-1		1 1		2		3	Some cracks with weathered color.								. 🔡	İ	
7	1 1				Grey			,			2.2			-			-7		
	흥					2		2	•		= n			-			L		
ľ	سىلىسلىسلىدىنا Slightly shaly					.\$				١.,	-						-		
9	htly.	H				1		\$				٠			1.44		و 🛓 ،	İ	
	-1 77 7							1								.	F		12.4
60	<b>a</b>	rink K	N N Davara			$\dashv$	1	1	▶ driller's note €	<u> </u>	للبا						<u> </u>	<u> 101</u>	1314
		1	图图	•			1		ick), 2 (substick), 3 (piece), 4 (fragment), 5 grain										
			<u> </u>	RQD		] 1 (f			5 (soil) omposed)								•		•
		. 1	:[	cuttings								EI.	ECTR	ac i	POWI	er d	EVELOF	MEN	n co., lm
		Į.							-21 <b>-</b>						1	OKY	O. JAPA	N	

		ATI	ON		m _left _191.4	banl	OJE		DE		No.   Q,Q I. 5	w	CC	ММ	ENC	CED	of 4 Jul 2 Aug 2	<u>3 – 198</u>	<u>3</u>
	coc	RDI	NATE	1965	774.5N	375	425	<u>7</u> E	LE	NGTH OF ROCK DRILLING 78	8.5	m	DR	ILLE	DΘ	Υ	ROE	M	_
					ZONTAL E HOLE			▔ .		TAL LENGTH OF CORE 7 PRE RECOVERY 9	<u>7. O</u> 8. L		LO	GGE	DE	3Y	M. Shi	<u>bata</u>	<del></del>
ſ		ω S			٠. u	L		****		ERVATION OF CORE	T			_			-	Z	٦
	ОЕРТН	ROCK NAME	L 0 G	CORE	CEMENTA. TION KIND OF SIT	COLOR	WEATHER	HARD.	CORE	DESCRIPTION	V	EAK!	R TABL R PRES IGE OF	SURE DRILL	ING '	WÄTE	I La	ELEVATION	
	60m			0 → 100 ਸ਼ਖ਼ਬਸ਼ਸ਼		_	ļ		ļ		20%	1	SRILL W	ATER	RETU	RN T	100 . 60m	131.4	mi ▼
	ا 5 3 بىلىدىلىدىلىدىلىدىلىدىلىدىلىدىلىدىلىدىلى					wis brown at cracks	₹	2	2 }	Hard banded or shaly limestone with some weathered planes of cracks.  A few solusion small cavities in part.							ավարկանական ավարկանի գ		
	2 6 2 1 2 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2					Grev, partially vellowis						Lu=1.7					5 min 6 min 7		
	20 مالسمالسياسياسياسيا	Limestone					3	3	3	Some small solusion cavities at 68,5m-69,5m							و والسلط		
	30 ع ع براسطيسلسيليييلسياس	shaly)					2 ( (3)	2 {	3 { 2	Banded limestone hard but partially weathered along cracks							70 hundani		
	5	(Slightly			e de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de l		3 2	3 4×5 2 1 3	3	Fault Somewhat cracky due to faulting.		- Lu=2.0					1 3 4 4 5		:
	وسياسياسيا		7 Y				3	4~5 3		75. 5 Fault. Small fault at 76.2m (dip 50°)							6		
	2 3 3 3 4 4 4 5 7 7 7 8 7 8 7 7 8 7 7 7 7 7 7 7 7 7 7						(3)	2	2 } (3)	Weathered crack at 77.3 <sup>m</sup>		— Lu≐2,5∵					7 8 8 9		
			[O]						3								80	101,4	
	<del></del>	<del></del>		N			1		1	▶ driffer's note €						<u>.</u>	- 50	<b></b>	
			1	1 13	core loss			10		ick), 2 (substick), 3 (piece), 4 (fragment), 5 grain 5 (soft)									
				1	RQD		1 (1			composed)									
					cultings			:	· ·	-22-			ELEC	TRIC			EVELOPMI O. JÄPAN	2VT CO., 1	LTD.

	IZONTAL <u>90</u>	DEPTH OF HOLE DEPTH OF OVERBURDEN LENGTH OF ROCK DRILLING TOTAL LENGTH OF CORE CORE RECOVERY	E No. S -   (SHEET   OF 3 )  43.5 m COMMENCED Mar. 24 - 1983  1.0 m COMPLETED Apr 2 - 1983  42.5 m DRILLED BY ROEM  6.9 m LOGGED BY M.Shibata
DEPTH ROCK NAME LOG CORE RECOVERY	CEMENTA. TION TION BIT CASING COLOR WEATHER	OBSERVATION OF CORE  OBSERVATION OF CORE  OBSERVATION OF CORE  OBSERVATION OF CORE	WATER TABLE
om 0 → 100 - do 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(Light)	Brown silt~clay (Maybe overburden)	20\ DRILL WATER RETURN 100\ 0m 126.2 \ \frac{m}{v}
2-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1		Cuttings (?)  Materials are mixture of grey and yellowish brown particles.	8 4 5 1 1 2 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2
4-11-11-11-11-11-11-11-11-11-11-11-11-11			¥
6-1			X X E 6 E 6 E 7 E 7
ered rocks?	and grey)		K= 624 × 10 <sup>-3</sup>
Strongly weathered	(Yellowish brown		E- 10 E- 10 E- 10 E- 2
aterials (s	(Ye	14.0 Cuttings (?)	10-3 10-3 10-3 10-3 10-3 10-3 10-3 10-3
Soft me		Medium grained particles (similar to san	¥ 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
7-1	nish yellow)		0
9 20	(Brownish	> driller's note 4	20 106.2
	- core foss - RQO 1	1 (stick) 2 (substick) 3 (piece) 4 (fragment) 1 (hard) ~ 5 (soft) (fresh) ~ 5 (decomposed)	grain
	cuttings	-23-	ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO, JAPAN

	Nam	Yuan		PRO	SJE	CT		HOLE N	10.	S	1						
	ATION:		Spillway	•		<u>.</u> .		PTH OF HOLE 43.									1983
	NOITAV		126.2	· · · · · ·	014	_		PTH OF OVERBURDEN I.									- 1983
			395,3N					NGTH OF ROCK DRILLING 42								ROE	
				3	<u>}Q</u> _	-		TAL LENGTH OF CORE 6.			, ,L	.OG	GED	ВУ	V	1. Shit	oata
BEAL	RING O	FANGL	E HOLE				CC	RE RECOVERY 19.	_2_	%					1.j		
· [	¥.	à	یں کے					ERVATION OF CORE	Ι.		D T.	D) 6					₫
08 93 H	POCK NAME	CORE	CEMENTA TION KIND OF BIT CASING	8	WEATHER	HARD.	CORE		1		1		RE TE			DEPTH	¥.
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20m		0 +100		-	3		ļ <u>~</u>		+		PILL	WAY	EA RE			00 \ 20m	106.2 🖫
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1 1	Mater Mater	MMM	}	(Brownish)										٠ .	1	E	
2-3	ΣE	WW.		<u>.</u>				22.0	ł	7,						-2	İ
1 1	-							Black cuttings,	1	]							
3.3								non-calcareous	l	'n		} }	-			3	
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1 4										20×10-3			l_			Ē,	
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1.1		MM	]							굮		.		1		E. 1	
1 2 4	<u> </u>	MM	} .					Probably soft or							1	5	. [
		MIM		]				brittle part of black		ю				- 1			
6-3	.	MM						shale rocks.		6						6	
1 1	2 =	HHHH						situle rocks.	T	.57×10-	$\vdash$		_	$\top$	+	Ē	
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8-	¥	MMA		상						×				1		8	
-	Black			Black)									- 1				
9-3	9	KHHH		=				Bedding planes are not so clear.		0				H.		9	
=	-	MMM						not so clear. Black shale, graphite		×	i	┝╌┼		╁	+	<u>-</u>	. ]
30-		<i>WWW</i>			Ī			rich.	Ý	88					-	30	
4								Some rock fragments		Ŋ						-	
1 1-		KKK						31.0 and cuttings.		7				-		-1	
1 4	2					3	4 5	Many thin calcite veins.					İ				
2-4					ļ	4		32.0 Brittle in general.					l			2	
	-	<b>a</b>				3	4									Ē	
3_	0 ~~					4	4		٠				ĺ			3	
1 1	shall shall		*	ید	2	5	5	Sheared and clayey									
4 4	χ. 	2 IIII	1	Black		1		a† 32.7∼ 33.5™					-			Ĺ4	1.7
]	Black Black			CD.		3	4	Mostly gravelish cores.	l					1.	1	E.	
5	<b>™</b> 35∠						3	grand and the second second		l						- 5	
1 1	Ž.							<b>35.5</b>					-			Ł l	
6.					- 7				l				-			Ĕ. 6	
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8-	8 60 77 77	M		¥	-:-			39.2 Chagrad black elever								9	ļ
1, 13	30-4 66		R. Carl	Black	2	1√5 3	4√5 4 3	Sheared black clayey materials at 39.3 ~ 39.4m					1			40	86.2
40 ⊒0	<u>⊢ νη                                   </u>			-wil	1	Ť	الب	b drifter's note 4	بب							<u> </u>	
		13 KJ	130				[] [] (s)	ick) 2 (substick) 3 (piece) 4 (fragment) 5 grain						2			
		// V/	core loss			1 (1		5 (soft)									
		ــــــــــــــــــــــــــــــــــــــ	RQD		1 (1	esh) -	· 5 (da	composed)			٠.						
	. 1		cuttings						٠		EI.	ECTR	ac P	TI VC	DEV	ELOPME	NT CO., LTD
		1		11.			1.7	-24-						TO	KYQ.	JAPAN -	

	Spillway 126,2 395,3N 375 ZONTAL	m 0014.21 90	Di L Di E L T	EPTH OF HOLE 43. EPTH OF OVERBURDEN 1. ENGTH OF ROCK DRILLING 42. DTAL LENGTH OF CORE 6. DRE RECOVERY 19.	10. S -   (SHEET 3 OF 3 )  5 m COMMENCED MOR24 - 1983  0 m COMPLETED ADR 2 - 1983  .5 m DRILLED BY ROEM  9 m LOGGED BY M. Shiboto  2 %
DEPTH ROCK NAME LOG CORE	CEMENTA. TION KIND OF BIT CASING	WEATHER	HARD. NESS CORE GO	DESCRIPTION  DESCRIPTION	WATER TABLE
40m 0 = 100 %			3 5 (3	Generally brittle.	DRILL WATER RETURN 100×40m 86.2 m
shale	200	s algo	4-54~ 4 3	Sheared black clayey materials at 41.3 – 41.4 <sup>m</sup>	
Black	Q	u I	3 (3	Black clayey materials at bottom of hole. Bottom of hole at 43.5 m	82.7
4					E-4 E-1 E-5 E-5
6 tr					6
7- - 8	:				E-7
المسالير ماسيالير					
9-11 0-11 1-11 1-11 1-11 1-11					
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6 H					- 6 7 - 7
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0 min.			1 1	Adillate one 4	
	care toss	ı (be	i (hard)	b driller's note 4 slick), 2 (subslick), 3 (piece), 4 (fragment), 5 grain - 5 (soft) ecomposed)	
	cuttings			_ 25 <i>_</i> _	ELECTRIC POWER DEVELOPMENT CO., LTD, TOKYO, JAPAN

			Nam	<u>Y</u>	<u>ua</u>	m	PRO	JE	CT		HOLE									
		ATI		٠.:	<u> </u>	Intake		<u>.</u> .					m						8 _ 1983	
						143.6 516.2N 37	75.4	926											<u>7 -1983</u>	
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				1.7		E HOLE						<u>. 5</u>		. Ļ	00	GLU		111, 011	Dato	
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	БЕРТН	ROCK NAME	0	CORE	RECOVERY	CEMENTA. TION KIND OF BIT. CASING	8	H S	33.5	я Ş	DESCRIPTION	Į.		R TAE		RE TES	γ~	OEPTH	ELEVATION	
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	1			Ш							from 0 to 4.0 <sup>m</sup>							E		
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	2	der	Δ	][[]			(Brown)		ļ	İ.								E 2		
·	-	Overburden					(Bro													
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	4			Щ	Ш				٠	<u> </u>	4.0		10-13					4		
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	5-	~			M		grey				Cuttings (Non-calcareous)	1	Γ.	H		-	₽	5		
	ulm	o e		棴	M		brownish				/ (AOU - colour Gods )		ις II		,	-				
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	, 1	ōğ Ked					(Grey∼					1			ļ					
	8 - 1	<u> </u>			$\mathcal{W}$		9)	~~			8.0 Weathered black shale							E 8		
	الما	و ي	<u> </u>	11111			ck 3	3	3 }	3	Foult breccia at 8.3m - 8.5m		19					Ē		
	9	Spice	-	11  }	W		Light grey ~ brack	3		(4)	Vector red older state  Foult breccia at 8.3m - 8.5m  Dip of foult = 60°  (Thickness 5~6cm)  Generally cracky		×				4	-9		
	1		eq		W		.) (				95 Core loss	A,	3.11×10			+	+-			
	10-1			쌦	14						10.0	11	<b>Y</b>					- F- 10	<u>'                                     </u>	
	1	2		₩	$\mathbb{N}$						Brownish grey							E	*.	
	1	shale		Ш			( Y	·	7.	:	Cuttings (as same as at 4.0m -8.0m)									
	2			₩	$\mathcal{M}$		grey				(Non – colcoreous)	H	4					2		
	1	plack		$\mathbb{M}$	W		ish				(14011 - 0010010000)	1	03×10-4							
	3_	ed		₩	N		rownish		1				03					3		
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	- 1	$\overline{}$		$\mathfrak{M}$	M						Brownish grey cuttings		4		ŀ	.   1	1	E .		
	7	9		₩			grey)	Ť,	2		(Non-calcareous)		ρ×					[ 7		
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8	Î	e S		W	$\mathbb{M}$		vnis		4				4				-			
	9-	<b>5</b> 00		$\mathbb{M}$	M		Brownish						쏘		٠			E 9		
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	<u>E 05</u>		 /	Ш	M			3	3	4~3 1	Gravelly cores	Щ	لبا	<u> </u>			1	L F 20	123.6	
1.5			į	) F	13					1 (5	ick), 2 (substick), 3 (piece), 4 (fragment), 5 grain									
			12	1	`L <u>`</u>	core loss		1	1.00		5 (soit)		:							
		i ya	4	ـــا ر	, e. 35.	RQD		(1	resh) -	- 5 (de :	composed)			<b>272</b>		;	wirm	DETER AND	IENTE CO	
				-	77	cuttings	٠.	4			26			ĽI.	E-011	ut PU		DEVELOPA YO, JAPAN	IENT CO., LIT	١.
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	DEPTH	POCK NAME	0	CORE RECOVERY	CEMENTA TION KIND OF BIT CASING	COLOR	ΞŽ	HARD.	34 E	DESCRIPTION	W	ATE	R PRE	SSUF	E T	EST			рертн	ELEVATION	
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ĺ	-3	(Black) Shale?)		MM		<u>કે</u>				20.0 Cuttings					1						
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	, I		0°			Light (Grey)	3	3	4 3	Gravelly cores of wheathed 22.0 black shale											
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-	4-1	$\stackrel{\sim}{}$	5/					-		24.0					- [				-4		l
	1	ŀ	-							Weathered black shale. Partially and slightly			:						<u>.</u>		İ
-	5-3		-			کرن کرن		3	3	brittle	-	1			-	$\vdash$			5		
.	- 1	shale	6A			Brownish grey	3	ξ.	7	Weathered along some				İ							
-	6-3					isi_	·	(4)		bedding planes and cracks.				-  -					6		
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1	ا و	<u>6</u> 7				<u>ā</u>						1			1	İ					
	, ,	ł	5	1118					3	Black shale weathered						ı			- 9		
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١	1	· <u>E</u>				~				Cores are generally broken into small pieces.					-	ł					
1	2-	ŀ	$-\parallel$			cracks)			4	proken mio sman pieces.									- 2		L
	-	1		Ŋ				3		Partially minorfolding.		۲.			1						l
	3-4	ļ				along			`	(With quartz veins)		11				1			-3		
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1	4						_	1		Generally somewhat cracky				ŀ	.				- 4		l
						brown	3	(4)	.	rocks.									-		l
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	7-		&		.	約	.		3	Small solusion cavities		-			١				- 7		
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	- 1	1	5_		]	Grey	7	. 2		2. 31.4 37.3				ĺ		ı					l
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				1	core loss RQD		1 (6			5 (soft) composed)											
			· L	-1			•••	-					RI I	CTRI	C P	ነው።	ge n	EVE	i Vana	NT CO., LT	TD:
					cuttings					-27 <i>-</i>				10					APAN	50,, 11	-,
										<i>21</i>											

	lght bank D 12.2 m D 8N 375 447.3E L TAL 90 T	EPTH OF HOLE 60 EPTH OF OVERBURDEN 6 ENGTH OF ROCK DRILLING 54 OTAL LENGTH OF CORE 34	.8 m LOGGED BY M. Shibata
w > 4	L OBS	SERVATION OF CORE	WATER TABLE TEST WATER PRESSURE TEST WATER PRESSURE TEST WATER TEST WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATER WATE
2	7 0 M 7 05		DRILL WAYER RETURN 1001 0m 142.2 m
Overburden			20 × 10 × 10 × 10 × 10 × 10 × 10 × 10 ×
Weathered shale	Brownish grey 3 2 4	6.0  Black shale?  Rock color is changed to brownish grey due to weathering.  Generally gravelly cores.	X = 2
2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Somewhat weathered as a whole. Generally cores broken along bedding planes.	⊕ ⊕
Black shale shale shale	Black, partially 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Partially weathered along bedding planes.  Most of cores are less than loom long.  Longitudinal crack with red plane at 19.5-20.5 m	O S = 7
core to	1 (fresh) - 5 (de	▶ driller's note 4 tick), 2 (substick), 3 (pisce), 4 (fragment), 5 grain 5 (soft)	ELECTRIC POWER DEVELOPMENT CO., LTD. TOXYO, JAPAN

	Ŋ	am	Yuan		PRO				1.5	ΕN			- 1				of 3	
		ON	. <u>Da</u> i	m right						<u>60.</u>			CC	MM	ĖNC	ED	Aug - L	8 - 1983
ELE			1966	142.2 5518N3			<u>n</u> 30:	2.0	PTH OF OVERBURDEN	6								l - 1983
				ZONTAL		<del>77.</del> .			NGTH OF ROCK DRILLING TAL LENGTH OF CORE					ILLE			ROE	
			6.3	E HOLE			<del>-</del>			<u>34.</u> 64.			ĻO	GGE	ט ט	Y	M.Shi	DOTO
	r	Γ		Γ.	T				ERVATION OF CORE	<u> </u>	-'-	70	<del></del>	··			<del></del>	Т — Т
ОЕРТН	ROCK NAME	00	CORE	NO.	œ	ξ.,	200 000						R TABL		-1	۸	Обетн	ELEVATION
96	ğ	ا د	υ . Ε	CEMENTA TION KIND OF BIT CASING	COLOR	WEATHER-ING	MARD. NESS	CUTTING	DESCRIPTION			11.15	R PRES					3
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2,0/11		150	<b>Ž</b> alili	<b>a</b>	ž	2	2~	3			) <b>.</b>	A	, <b>*</b>	Τ-		П	100 ZO.	122.2
		~~		a die	Black	3	4	3 4	Sheared at 20.6 - 20.8m							.	🖹	
14				(Darkgrey)					Cuttings Somewhat								[1	]
				S//	ネン	3	2~3	3	weathered, generally					1			E 2	
1 1					A Se				Cuttings generally cracky.			9.					[ 1	
3					Brnish grey	3	3 2	3 (4)				   ⊐				lЦ	E	
1				<i>≨</i> \	ത്ത		2	(4)	<del></del>	i						: :		
4-	:	75.2	MAG	-6	` .			-	Cuttings								<u> </u>	
=		0_		(Dark grey)		3	3	3	24.8					'			[-	
5-		20	4	키					Slightly weathered			+	+	+	-	╁		
	- 1					2	2	3	along bedding planes						-	-	E	
6-1						.5	-5	\$	diving bedding platies.								F 6	:
1 1			9			3	3	(2)	Partially flaky.			ľ					🖺 .	
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30-				:					brittle. Cuttings	ŀ		X		+	-	+	- 30	
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1-	00								31.0									
									Some cracks reddish at its planes.									
2 1					Black	. [				_		3.8					E-2	
					ă	3	3	3	Graphite rich at 32.5 <sup>m</sup> -32.	7'''		=						
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1	-					3	į	3	along some cracks.	-		b						
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		K	य ६५	core loss			] 1 (h		5 (soft)	J. 444								
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Į		Overburden	Δ				Yeli. Drn.	9	i G		1.0 -2.0m	].								
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Ì	8	몽					본			3	generally cracks								E 8	
		쑹	<u></u> တိ-				<u> </u>	<u> </u>			6.4								E	
	7-	Blac			}		ack	2	2	3	Hard shale, some cracks are sustained by oxidation in reddish colour.					-			7	
	- 4	"					8	3	2	(4)	in reddish colour.	·							1111	
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L	E 02			NAMA TATA					1		▶ driller's note ◀	Ш	×					1	£ 20	83.9
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	- cuttings							-31 <b>-</b>			ĸIJ	eu (R)	UP			EVELOPME 1. JAPAN	NT CO., LTD			
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LOC				n right. 103,9	bd		_												_ 1983
ELE				· · · · · · · · · · · · · · · · · · ·	3/5	412		DE	PTH OF OVERBURDEN 2. NGTH OF ROCK DRILLING 78	0	m	C	OM	iPL	ETI	:D	<u>QC</u>	ROE	M
				ZONTAL		<del>9</del> 0			TAL LENGTH OF CORE 52.9			l I	ARIL OG:	GE!	D B	τ :Υ	M	Shil	oata
				E HOLE			- -		RE RECOVERY 67.			_		-					
	ñ		>					OBSI	ERVATION OF CORE	T			:					T	Z
ОЕРТН	NAM	0	CORE	CEMENTA TION KIND OF BIT: CASING	ä	Äο	SS	ŭ Z	·		44.		BLE ESSU					ОЕРТН	ELEVATION
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	$\overline{}$	П	immi						Pale green cuttings,				Ĭ						
[	ze.				en C				(no reaction with acid)									ī,	
']	S G			:	(Pale .	,			The reading time and	ľ						H		<u> </u>	
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1	Suc				Whitish greenish grey			2	Weakly schistose,		-4	<u>.</u>	$\sqcup$						-
3-3	Caicareous shale		KHH I		8	2	2	,	bedding not so clear.		<u>0</u>							-3	
1 4	货등				Pitis 9re			3			95,							-	
4-1		Щ			≯				24.0 - 24.5 <sup>m</sup> Core loss.	$\{\ \}$	ΝÍ			٠				- 4	
1 =	$\triangle$		####		-		7- 2				굮							-	
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1 1		ijij							Whitish part is rather				.					-	
6-					grey			2	calcareous than									-6	
1						-	2	5	greenish part.		ဖ	÷	ŀ						:
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9	,	8/1			Whitish		(4)	3 ~ 4	Slightly sheared around									و_	
1 4				1	≫	2	-		28.5 <sup>m</sup> somewhat brittle in part.				1. [						.
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1 4							5	5	Rather greenish shale.		÷		GL	/ . 20	1			-	ł
1-	o l						3.	3										1 -	1
	sha							3	Somewhat flaky due to		ထ		li					-	.
2-	٠,					İ	3	~4	shearing at 31.7m-32.4m		Ö	:						-2	. }
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8		41				-	(3)	1	38.2		3							-8	l
	छ				ر ا				Cuttings at 38.2 <sup>m</sup> . 41.0 <sup>m</sup>									<u> </u>	
"]	유웨				Greenish Grey														
40	ુ	Ш			<u>ં</u>						V	ا						40	63.9
		E					1	<b>†</b>	▶ driller's note ◀										
		K	193 K	core loss			1,0		ick), 2 (substick), 3 (piece), 4 (fragment), 5 grain 5 (solt)										
	1.		<u> </u>	RQD		1 (1			composed)										
	÷.	:		Cuttings				-				EI.	ECTI	RIC					NȚ CO., LTU
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DEPTH POCK NAME	CORE	RECOVERY	CEMENTA. TION KIND OF BIT CASING	8	¥EATHER ∴NG	-CS3+	CORE	DESCRIPTION	200	WATER P				ОЕРТН	ELFVATION
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	DEPTH	POCK NAME	0 0	CORE	CEMENTA TION KIND OF BIT	9 L	8	H O						100	BLE	1	<b>W</b>		<b>БЕРТ</b> Н	ATIO.	
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	6	_	Цij		,	4	P <sub>Q</sub>				at 55.2 <sup>m</sup> − 55.3 <sup>m</sup>								6	:	
	4	١	: /II								From 56 <sup>m</sup> to 60 <sup>m</sup> , core		1					. 7		,	
-	7-		\ /						ŀ		box is lost.  Driller reports during		7.						7		ł
	81		VII								transportation, the core	٠.	,u					*			
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1	9		$/ \parallel$								+								-9		
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L	VV 그		 	3   <u>13</u>				l	<u>-</u>	L 	♦ driller's note ◀	L	L.Jl				1	Ļ <u>.</u>	60]	<u> </u>	
				图	care loss						ick), 2 (substick), 3 (piece), 4 (fragment), 5 grain										
				1	RQO			   (le			5 (solt) composed)										
٠.				-	— cutti	ngs								EL	ECTRI	C POV				NT CO., I	.TD,
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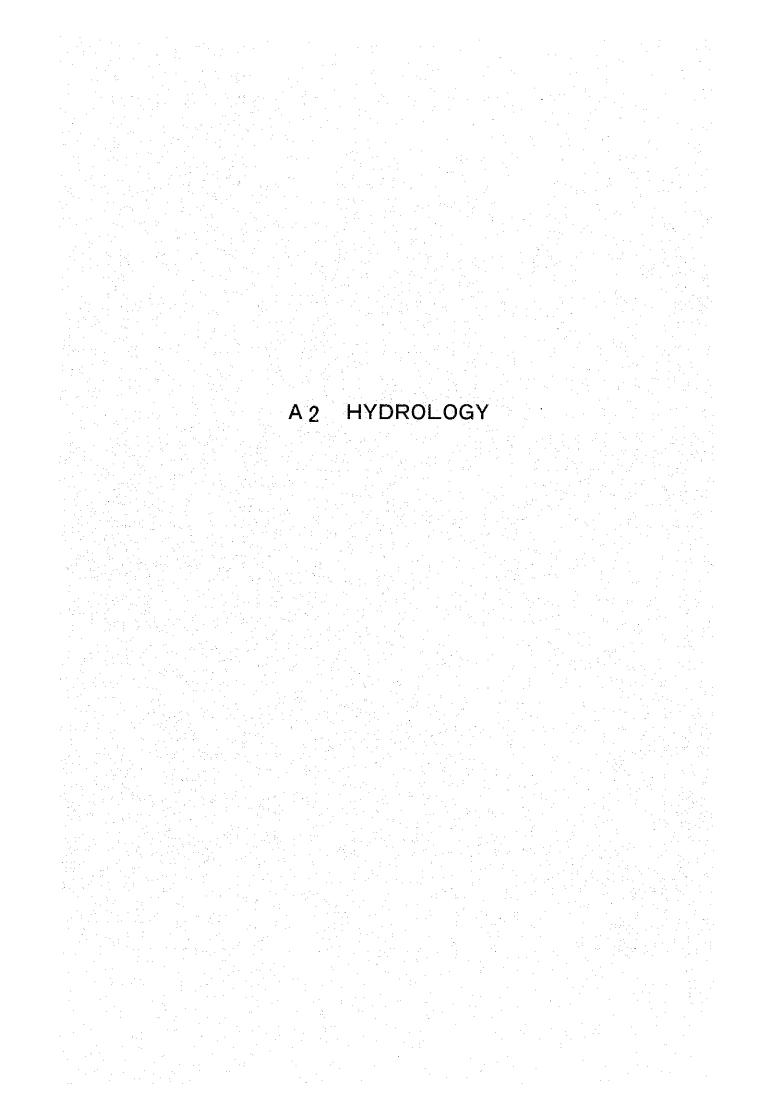
ELEVATION	m upstream 91.3 m 333.3N375 398.2E	DE DE LE TO	HOLE N PTH OF HOLE 120. PTH OF OVERBURDEN 6. NGTH OF ROCK DRILLING 114 TAL LENGTH OF CORE 79 RE RECOVERY 70	O m COMPLETED Oct21 -1983 O m DRILLED BY ROEM 9 m LOGGED BY M. Shibata
DEPTH ROCK NAME L O G CORE RECOVERY	CEMENTA. TION KIND OF RIT CASING COLOR WEATHER ING	CORE CUTTING	ERVATION OF CORE  DESCRIPTION	WATER TABLE Y STANDARD THE STANDARD STANDARD THE STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD STANDARD
Calcareous shale	Pall greenish grey	3 3 5 5 4) (4)	Quartz veins at 60.6 <sup>n</sup> -60.7 <sup>m</sup> and 61.55 - 61.65 <sup>m</sup> Somewhat brecciated in part and brittle.  64.6 <sup>m</sup> Fault zone with clay and breccia and sheared	DRILL WATER RETURN 100x 60m 22.1 m
Fault Zone  Fault Zone  Fault Zone	5 2	3 3 3 3 4 4 3,4	rocks. Generally brittle. (Sheared at shaly part) Not sheared at limestone 67.6m  Very slightly weathered as a whole. Most of cracks somewhat weathered.	9 0 = 7   1   1   1   1   1   1   1   1   1
ilmestone	ight yellowish grey	:	Slightly banded and shaly.  Sheared and brecciated	70 11 11 12 13 14 13
4	with thin grey, partia	2 2 5	at 73.4 - 73.5 m (reconsdicted) Weathered a long cracks. Slightly banded (with greyish stripes) limestone. Partially slightly weathered along cracks or cross joints.	S O = 1 = 8
9-11-11-11-11-11-11-11-11-11-11-11-11-11		3   3   1 (s 1 (hard) -	Clay seam at 79,8 m  • driller's note 4  lick) 2 (substick) 3 (piece) 4 (fragment) 5 grain  5 (soft)  composed)	ELECTRIC POWER DEVELOPMENT CO., LTD
	— cuttings		-40 <del>-</del>	TOKYO, JAPAN

			Yua		PRC		СТ					2	(S	HEE	<u> </u>	<u>5</u> (	OF (	ĵ )	100	z
	LOCATIO		<u>Dar</u>	m ups 91.3			 n		PTH OF HOLE <u>I2O</u> PTH OF OVERBURDEN <u>6</u>			Ç	MO	ME	NC	ED	Oct Oct	2	198:   -198:	ر ج
			1966 3	333.3N 37					NGTH OF ROCK DRILLING 114.				RIL				<u> </u>	ROE	VI	•
	ANGLE	ROM	HORE	ZONTAL	_6	60	_		TAL LENGTH OF CORE 79				OG				М	Shib	ata	_
	BEARING	OF	ANGL	E HOLE	<u>N3</u>	ΙE		CO	RE RECOVERY 70											
	ME		` <u>}</u>	έχδ o		16	1	OBSI	RVATION OF CORE	V	VATE	R TA	BLE		4/	۰			Š	].
	DEPTH COCK NAME	0 0	CORE	CEMENTA TION KIND OF BIT CASING	COLOR	WEATHER-ING	HARD. NESS	Ž,	DESCRIPTION	1	VATE			RE T	EST	٠.		OEPTH	ELEVATION	
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	80m		กราสบาร์		:				2	   		RILL	ο WAΥ	ER R	ETUF	iN ,	10	3 . 80m	4.8	<u>*</u>
	1					2	2 \$	2	Generally cracky		1							_		
	1-	71		. •	_		1	(3)	and weathered color									-1.		
	باستاستاس	H			partially rellowish		3	4	along planes of cracks.		1							-		
	2	H			P S	3	2	3	(No solusion phenomena)		8							2		
Ì	7	$H^{2}$			e grey	3	2	1	(Bedding planes not clear)		11 23							-3		
	3 1 1	1 1			a e	2	5	3	Clay seam at 84.1m		=							-3		
	4-1				D.98		3											4		
	17	15°			_			ļ								:		-		
	5	1 1 1				-			Fresh slightly shaly	-	X				<u> </u>		-	5		
			#			*			limestone.									- 1		1.
١	6-	1 F							Partially slightly									<u>-</u> β	:	
l	- T		##						flaky along bands		3							7		
ļ	7-3	1 +					2	2	(One kind of sheared		2	٠.	. :							-
l	and to the	$H_{\parallel}$				, <b>1</b>	5	5	planes?)		=							8		
Į	imestone	1 H	9						Generally massive.		_									
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	و Shaiy	H								-	*							- 90		
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		Blackwith white bands											E.		
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14				- :		44						OKT	O. JAPAN		



#### 1. Catchment Area of the Damsites

In this study, two damsites, i.e. site A and B were proposed for investigation. Catchment areas of both sites were measured with the available topographical maps (scale: 1/250,000, "Chiangwat Chiang Mai" and "Amphoe Li") published by U.S. Army Map Service, Far East.

Catchment area of Ban Tha Rua G.S. was also measured with the said map.

The catchment areas employed in the study were as follows.

Damsite A :  $5,920 \text{ km}^2$ 

Damsite B :  $5,810 \text{ km}^2$ 

Ban Tha Rua G.S.:  $5,770 \text{ km}^2$ 

#### 2. Evapotranspiration

Evapotranspiration was calculated by the following two methods.

#### (1) Thernthwaite Method

$$E_{\rm PT} = 0.533 \text{ Do } \left(\frac{10 \text{tj}}{\text{J}}\right)^{\text{a}}$$

where

$$a = 6.75 \times 10^{-7} J^3 - 7.71 \times 10^{-5} J^2 + 1.79 \times 10^{-2} J + 0.49$$

$$J = \sum_{j=1}^{12} (\frac{ti}{5})^{1.514}$$

 $E_{PT}$  = Monthly average of daily evapotranspiration [mm/day]

Do = Daytime ratio i.e. daily daytime/12 hrs

t = Monthly average temperature [°C]

j = Month (1 - 12)

J = Indicator of Month

#### (2) Blaney and Criddle Method

 $E_{PT} = KCt$ 

where

EpT = Monthly average evaporation
[inch/month]

C = Ratio of monthly daytime to annual daytime

t = Monthly average temperature [°F]

K = Coefficient corresponding to kind of flora

When units are converted to metric system, the equation becomes:

$$E_{pT} = K \cdot C \cdot (45.72^{t} + 812.8)$$

In these equations, daytime ratios Do and C were obtained by the following way.

Do; based on the table below, the value at latitude 18° North was interporated.

C; given by the following figure.

Coefficient for flora (K) is 0.7 corresponding to deciduous forest in semi-dry region(1).

#### References

(1) Hideaki Nakano, "Forestry Hydrology" p.p.95 - 120, 1980. 3rd ed. Kyo-ritsu Press.

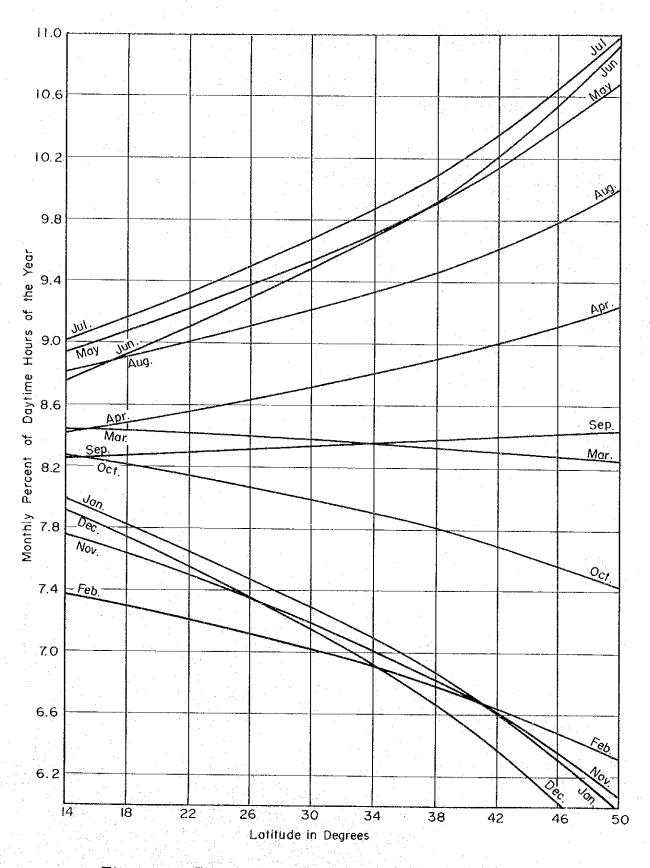


Fig. 2.1 Percent of Annual Sunshine Hours Occurring During the Indicated Month

Table 2.1 Daytime Ratio, ref. (1)

(Unit: 12 hr/day)

	46	52	55	12	986	23	240	302	274	77	045	60	87	21
	4	0.7	0 8	0.8	0	p1	-	<del>-</del> -1			1.0	0.909	0.7	0.7
	777	0.770	0.865	0.867	0.988	1.115	1.223	1.280	1.255	1.162	1.041	0.915	0.803	0.742
	75	0.787	0.875	0.877	0.989	1.107	1.208	1.261	1.237	1.151	1.039	0.921	0.817	0.760
	Q <del>7</del>	0.802	0.884	0.885	0.990	1.100	1.193	1.242	1.221	1.141	1.037	0.927	0.830	0.778
	38	0.817	0.893	0.894	0.991	1.093	1.180	1.225	1.206	1.132	1.035	0.932	0.842	0.794
	36	0.830	0.900	0.902	0.992	1.087	1.167	1.209	1.191	1.123	1.033	0.938	0.854	0.809
	34	0.843	0.908	0.909	0.993	1.081	1.156	1.194	1.177	1.114	1.031	0.942	0.865	0.824
	32	0.855	0,915	0.916	0.994	1.076	1.144	1.180	1.164	1.106	1.029	276.0	0.875	0.838
	30	0.867	0.922	0.923	0-995	1.070	1.134	1.166	1.152	1.098	1.027	0.952	0.885	0.850
	28	878.0	0.929	0.930	966.0	1.065	1.123	1.153	1.140	1.091	1.025	0.956	568.0	0.863
	26	0.889	0.935	0.936	966.0	1.060	1.114	1.141	1.129	1.084	1.024	096.0	0.904	0.875
	24	0.899	0.941	0.942	0.997	1.055	1.104	1.129	1.118	1.077	1.022	0.964	0.913	0.887
	20	0.920	956-0	956.0	1.000	1.048	1.087	1.106	1.097	1.063	1.018	0.971	676.0	606.0
-}	18,	0.929	196.0	196*0	100.1	1.044	1.079	1.096	1.088	1.057	1.017	0.975	0.937	0.919
	10	0,965	0.982	0.982	1.003	1.026	1.045	1.055	1.051	1.034	1.012	066°0	0.970	096*0
Lat.			(28)	(29)							7,247			
	Mon.	JAN	FEB	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC

Note: \*; Lat. 18°N. was interporated

#### 3. Sedimentation

#### 3.1 Geology in the project area

The project area stretches from North to South with distance of  $160~\rm km$  while from West to East with  $30~\rm to~50~\rm km$  width, covering catchment of  $6,000~\rm km^2$ . In the area, rugged topography in youthfulage is widely seen.

The area is mainly composed of sedimentary rock of Paleozoic and Mesozoic age, and granite of Mesozoic age. The ground is covered in most area by laterite which is generally formed by weathering in humid and high temperature region.

#### 3.2 Sediment

Due to the laterite covering the ground, eroded and flowing material in the river is very fine. In other words, the river flow contains suspended load. On the other hand, since the river gradient is rather mild and river flow is relatively slow, bed material would not be very involved in the flow. Measurement of suspended load has been conducted at three gaging stations along the river. But one gaging station was omitted because it measures on a tributary. Instead, a measurement on the Moei river was taken into account.

#### (1) Density of sediment deposit

The following equation gives an average density of sediment deposit after t years.

Wav. = 
$$W_1 + 0.434 \text{ K} \left[ \frac{t}{t-1} (1nt - 1) \right]$$

where Wav. = Average density of sediment deposit after t years.

 $W_1$  = Initial density of sediment deposit shown in the table below.

K = Coefficient

t = Years

Table 3.1 Initial Density and Coefficient

(Unit: 1b/ft3) Silt Clay Sand (0.005 to Reservoir Operation (>0.05 mm)(0.005 mm) $0.05 \, \text{mm}$ ) K  $\overline{\mathtt{W}_1}$ Wi K  $\overline{W}_1$ K Sediment always submerged or nearly 93 0 65 30 5.7 16.0 submerged Normally a moderate 93 74 0 2.7 46 10.7 reservoir drawdown Normally a considerable reservoir 93 0 79 1.0 60 6.0 drawdown 93 0 82 0.0 78 0.0

For a hundred year sedimentation, the following densities were derived

Table 3.2 Average Density after 100 years

	·	(Un	it: gr/cm <sup>3</sup> )
Reservoir Operation	Sand	Silt	Clay
	W100	W100	W100
Sediment always submerged or nearly submerged	1.490	1.185	0.886
Normally a moderate reservoir drawdown	1.490	1.254	1.008
Normally a considerable reservoir drawdown	1.490	1.291	1.113
Reservoir normally empty	1.490	1.313	1.249

In this study stage, no information is available for composition of sediment deposit in Nam Yuam reservoir. Therefore, an average figure of the said densities could be employed, i.e.  $1.30~\rm gr/cm^3$ .

#### (2) Estimation of sediment

Using the average density derived above, the suspended load measured in weight at gaging stations was converted to load in volume. At the same time the amount of load was expressed by form of specific discharge.

In addition, bed load was considered, referring other report. The report of Lower Quae Yai Environmental and Ecological Invistigation mentiones 10% of bed load against suspended load in terms of volume, while the Feasibility Study Report of Upper Quae Yai mentiones 20% thereof. In this report, thus, it is decided to consider 20% of bed load against suspended load in terms of volume.

Consequently, following sediments are estimated at each gaging stations.

Sop Han (C.A. = 2,496 km<sup>2</sup>) 
$$136.2 \text{ m}^3/\text{km}^2/\text{yr}$$
  
Ban Tha Rua (C.A. = 5,770 km<sup>2</sup>)  $109.6 \text{ m}^3/\text{km}^2/\text{yr}$   
Tha Song Yang (C.A. = 8,360 km<sup>2</sup>)  $196.9 \text{ m}^3/\text{km}^2/\text{yr}$ 

Finally the specific sediment discharge of 140  $\rm m^3/km^2/yr$  which is conservatively obtained by enlarging the figure at Sop Han has been adopted in this study. Therefore, the total amount of sediment deposit is estimated to be 82.9x106  $\rm m^3$ 

 $140 \times 5,920 \times 100 = 82.9 \times 10^6$  This sediment occupies only 18.6% of total storage volume of the reservoir. Assuming horizontal surface of deposit, sediment level becomes EL.129.0 m.

#### References

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