7.3.2 J-2 (Fig.7.3-2)

1) Lithology

The well drilled up 1,260m depth. Wadi deposit was observed at the depth from surface to 22.5m. Based on the results of micro fossil analysis and lithology observed, the following eight (8) major layers were classified.

Layer	Depth(m)	Lithology	Epoch/Age
1	22.5-263	Shale, Dolomitic Limestone, Chalky Limestone	Lower Eocene
2	263-303	Shale, Shelly Limestone	Paleocene
3	303-443	Chalky Limestone	Maastrichtian
4	443-563	Shale	Campanian
5	563-619	Dolomitic Limestone	Coniacian-Santonian
6	619-770	Dolomitic Limestone	Turonian
7	770-1,050	Shale, Dolomitic Limestone, Shale intercalated with Sandstone	Cenomanian
8	1,050-1,260	Sandy Shale, Sandstone, Sandy Shale	Lower Cretaceous

2) Well Logging

Results of well logging are as follows

Layer	Resistivity (Ω-m)		Gamma Ray(cps)	Spontaneous Potential(mv)	Temperature (°C)
	Short	Long			
1	1-16	1-9	2-50	706-836	31.6-32.5
2	1-6	1	3-41	736-813	32.5-32.7
3	4-11	1	3-68	718-860	32.7-34.2
4	1-27	1-9	16-98	749-903	34.2-35.6
5	1-31	1-40	7-38	779-858	35.6-36.1
6	3-97	3-163	2-47	795-913	36.1-38.7
7	1-138	10-334	2-50	808-990	38.7-46.9
8	7-464	3-1579	2-50	940-1063	46.9-52.2

3) Determination of Casing Design

Casing design is determined as shown in Fig.7.3-8. The layer is composed of intercalation of sandstone and shale. The geophysical data indicate that the layer is promising aquifer, except shale intercalation which Gamma Ray shows high value. The length of screen and casing pipes including sand trap are 99.61 m and 105.56 m, respectively.

4) Fossil Analysis

A total of 100 samples were collected for analysis. These samples composed of chalky limestone, limestone, shale, clay, marly limestone, chart, dolomitic limestone and sandy shale. Results of fossil analysis are presented in 7.3.2-1. Based on the results of

fossil analysis, following nine (9) Epoch/Age were confirmed.

Depth(m)	Thickness(m)	Epoch/Age
22.5-132	110	Middle Eocene
132-263	131	Lower Eocene
263-303	40	Paleocene
303-443	140	Maastrichtian
443-563	120	Campanian
563-619	83	Coniacian-Santonian
619-770	151	Turonian
770-1,050	280	Cenomanian
1,050-1,260	> 210	Lower Cretaceous

5) Grain Size Analysis

A total of 21 ditch samples were collected from the Lower Cretaceous formation. The collected depth is from 1,106m to 1,248m. The grain size of the samples is a range between 4mm and 0.5mm, and classified as granule to coarse sand. The distributions of permeability coefficient are shown in Table7.3.2-2. The permeability coefficient estimated by D_{20} is a range between 6.85×10^{-3}cm/sec and 1.8 cm/sec. The average permeability is estimated as 2.5×10^{-1}cm/sec.

6) Pumping Test

(1) Upper Cretaceous Limestone

An aquifer test was conducted by the airlifting at the depth from 620m to 650m of the formation. However, no groundwater flow have been confirmed.

(2) Lower Cretaceous Sandstone

Three (3) different kinds of pumping test method; three (3) steps draw down test, constant discharge and recovery test were conducted by submersible pump. The results of analysis are shown in Fig.7.3.2-1.

The aquifer constants calculated are summarized as follows;

Method	Transmissibility T:(m^2/min)	Storage S	Permeability *k*(cm/sec)
Jacob	2.41×10^{-2}	1.02×10^{-3}	1.45×10^{-3}
Recovery	2.65×10^{-2}	-	1.57×10^{-2}
Theis	2.41×10^{-2}	6.10×10^{-4}	1.45×10^{-3}

The average transmissibility of three methods is calculated as 2.49 x 10^{-2} m^2/min. The permeability coefficients are the similar with estimated permeability by the grain size analysis.

The formation loss and well loss are 2.88 x 10^{-2}(day/m^2) and 4 x 10^{-7}(day/m^2), respectively. Well efficiency at a discharge rate of 700 m^3/day is calculated as 99 %. No critical discharge is observed by the step draw down test.

Radius of Influence was given as follows;

$R(m)=10.551t^{0.5}$ ($Q=30m^3/h$) t: time of pumping operation(hour)

7.3.3 J-3 (Fig.7.3-3)

1) Lithology

The well drilled up 1,000m depth. Based on the results of micro fossil analysis and lithology observed, the following six(6) major layers were classified.

Layer	Depth(m)	Lithology	Epoch/Age
1	0-60	Chalky Limestone, Limestone	Maastrichtian
2	60-229	Claystone, Limestone, Shale	Campanian
3	229-301	Alternation of Shale and Limestone	Coniacian-Santonian
4	301-495	Alternation of Limestone and Shale	Turonian
5	495-771	Alternation of Limestone and Shale, Dolomitic Limestone, Sandstone in the lower part	Campanian
6	771-1000	Sandstone, alternation of Sandstone and Shale, Claystone in the lower part	Lower Cretaceous

2) Well Logging

Results of well logging are as follows

Layer	Resistivity (Ω-m)		Gamma Ray(cps)	Spontaneous Potential(mv)	Temperature (°C)
	Short	Long			
1	4-5	3-5	4-23	973-989	24.3-25.5
2	1-22	1-11	4-118	852-1025	25.5-27.4
3	4-48	1-74	3-42	982-1094	27.4-28.1
4	4-57	10-108	2-34	954-1057	28.0-28.7
5	5-128	1-351	3-66	982-1080	28.6-36.2
6	30-91	54-195	1-72	1037-1197	35.5-41.9

3) Determination of Casing Design

Casing design was determined as shown in Fig.7.3-8. The screen pipes were installed to cover the formation of sandstone. The length of screen and casing pipes including sand trap are 148.8 m and 43.4 m, respectively.

4) Fossil Analysis

A total of 50 samples were collected from the Upper Cretaceous formation. These samples includes chalky limestone, limestone, shale, clay, marly limestone, chart, dolomitic limestone and sandy shale. Results of fossil analysis are presented in Table 7.3.3-1. Based on the results of fossil analysis, following six (6) Epoch/Age were confirmed.

Depth(m)	Thickness(m)	Epoch/Age
0-60	60	Maastrichtian
60-229	169	Campanian
229-301	72	Coniacian-Santonian
301-495	194	Turonian
495-771	276	Campanian
771-1,000	More than 229m	Lower Cretaceous

5) Grain Size Analysis

A total of 30 ditch samples were collected from the Lower Cretaceous formation. The collected depth is from 780m to 1,003m. The grain size of the samples is a range between 0.5 mm and 0.125mm, and classified as medium sand to fine sand. The distributions of permeability coefficient are shown in Table7.3.3-2. The permeability coefficient estimated by D_{20} is a range between 9.0 x 10^{-4} cm/sec and 2.2 x10^{-2}cm/sec, and 5.6 x 10^{-3} cm/sec in average.

6) Pumping Test

(1) Upper Cretaceous Limestone

An aquifer test was conducted at the depth between 380m and 420m. The artesian flow was confirmed. The water head was more than 3.3m above the ground level. The maximum flow rate was 40m^3/h. The results of test are shown in below;

Time (hour)	TDS (ppm)	Temp. (℃)	Discharge (m^3/h)
0	2,490	25	-
1	2,700	27	11.6
2	3,900	32	36
5	4,200	33.5	40.01
6	4,422	33.5	39.37
7	5,120	34	29.7
8	5,500	34	18.4

(2) Lower Cretaceous Sandstone

Three (3) different kinds of pumping test method; four (4) steps draw down test, constant discharge and recovery test were performed. The results of analysis are shown in Fig.7.3.3-1. The aquifer constants calculated are summarized as follows;

Method	Transmissibility T:(m^2/min)	Storage S	Permeability *k*(cm/sec)
Jacob	2.29×10^{-1}	1×10^{-11}	2.56×10^{-3}
Recovery	1.34×10^{-1}	-	1.50×10^{-3}
Theis	-	-	-

The average transmissibility of two (2) methods is 1.82×10^{-1} m^2/min. The permeability coefficients are the similar with estimated permeability by the grain size analysis.

The formation loss and well loss are 6.7×10^{-3} day/m^2 and 3×10^{-7} day/m^2, respectively. The well efficiency at a discharge rate of 900 m^3/day is calculated as 96 %. No critical discharge was observed by the step draw down.

Radius of Influence was given as followings;

$R(m)=23.644t^{0.5}$ ($Q=30m^3/h$) t : time of pumping operation(hour)

7.3.4 J-4 (Fig.7.3-4)

1) Lithology

The well drilled up 1,130m depth. Wadi deposit was observed at the depth from surface to 30m. According to the results of micro fossil analysis and lithology observed, the following 9 (nine) major layers were classified.

Layer	Depth(m)	Lithology	Epoch/Age
1	30-80	Chalky Limestone, Chalky Limestone, Limestone	Eocene
2	80-112	Shale	Paleocene
3	112-252	Chalky Limestone	Maastrichtian
4	252-380	Shale	Campanian
5	380-420	Dolomitic Limestone	Coniacian-Santonian
6	420-594	Dolomitic Limestone	Turonian
7	594-845	Dolomitic Limestone, Shale	Cenomanian
8	845-1,106	Sandstone, Shale	Lower Cretaceous
9	1,106-1,130	Sandstone, Shale, Claystone	Jurassic

2) Well Logging

Results of well logging are as follows

Layer	Resistivity (Ω-m)		Gamma Ray(cps)	Spontaneous Potential(mv)	Temperature (°C)
	Short	Long			
1	3-91	8-64	11-79	1191-1250	34.4-34.7
2	3-16	8-19	9-91	1217-1220	31.6-32.5
3	10-27	15-30	5-46	1190-1220	34.7-36.0
4	6-30	10-44	23-190	1204-1222	36.0-36.9
5	3-28	2-26	6-53	1204-1222	36.9-37.2
6	4-108	6-222	4-72	1202-1269	37.2-38.0
7	4-111	7-233	5-77	1171-1234	38.1-39.0
8	2-57	19-62	4-86	1158-1252	37.2-42.4

3) Determination of Casing Design

Casing design was determined as shown in Fig.7.3-8. The layer is mainly intercalation sandstone and shale. The screen pipes were installed in sandstone. The length of screen and casing pipes including sand trap are 136.84 m and 111.87 m, respectively.

4) Fossil Analysis

More than 100 samples were collected from the Upper Cretaceous formation for analysis. These samples composed of chalky limestone, limestone, shale, clay, chalky limestone, dolomitic limestone and sandy shale. Results of fossil analysis are presented in Table 7.3.4-1. Based on the results of fossil analysis, following nine (9) Epoch/Age were confirmed.

Depth(m)	Thickness(m)	Epoch/Age
30-80	50	Eocene
80-112	32	Paleocene
112-252	140	Maastrichtian
252-380	128	Campanian
380-448	68	Coniacian-Santonian
448-594	146	Turonian
594-810	216	Cenomanian
845-1106	261	Lower Cretaceous
1110-1254	>144	Cambrian

5) Grain Size Analysis

A total of 23 ditch samples were collected in lower Cretaceous formation. Collected samples are classified as silt to fine sand. The distributions of permeability coefficient are shown in Table.7.3.4-2. The permeability coefficient estimated by the D_{20} is a range between $4x10^{-5}$ cm/sec and $6.85x10^{-3}$cm/sec.

6) Pumping Test

(1) Upper Cretaceous Limestone

An aquifer test was performed at the depth between 380m to 450m. However, no groundwater flow was confirmed.

(2) Lower Cretaceous Sandstone

Analysis data are shown in Fig.7.3.4-1. In stead of submersible pump, the airlifting method was applied for the test. Because, the static water level was deeper (501m) than the total head capacity of the available pump. Constant and recovery test by the airlifting was performed. A maximum discharge rate was 11 m^3/h. The aquifer constants were calculated as below table.

Method	Transmissibility T:(m^2/min)	Storage S	Permeability *k*(cm/sec)
Recovery	1.38×10^{-2}	-	1.69×10^{-4}

Radius of Influence was given as follows;

$R(m)=8.1388t^{0.5}$ ($Q=30m^3/h$) t: time of pumping operation(hour)

7.3.5 J-5 (Fig.7.3-5)

1) Lithology

The well drilled up 557m depth. Based on the results of micro, fossil analysis and lithology observed, the following five (5) major layers were classified.

Layer	Depth(m)	Lithology	Epoch/Age
1	0-168	Limestone, Marl, Shale	Turonian
2	168-310	Shale, Limestone	Cenomanian
3	310-500	Alternation of Sandstone and Shale	Lower Cretaceous
4	500-515	Sandstone	Carboniferous
5	515-557	Shale, Clay, Chart and Sandstone.	Cambrian

2) Well Logging

Results of well logging are as follows

Layer	Resistivity (Ω-m)		Gamma Ray(cps)	Spontaneous Potential(mv)	Temperature (°C)
	Short	Long			
1	1-62	1-114	5-78	1031-1503	22.0-25.6
2	1-141	1-152	10-75	1006-1206	25.6-28.2
3	12-86	5-145	8-83	1094-1205	28.3-31.0
4	22-29	35-46	10-25	1197-1209	31.0-31.4
5	23-49	23-70	10-68	1197-1247	31.4-32.4

3) Determination of Casing Design

Casing design was determined as shown in Fig.7.3-8. The layer is mainly intercalation of sandstone and shale. The length of screen and casing pipes including sand trap are 99.52 m and 80.77 m, respectively.

4) Fossil Analysis

A total of 30 samples were collected from Upper Cretaceous formation. These samples include limestone, shale, clay, chart and sandy shale. Results of fossil analysis are presented in Table.7.3.5-1.

Based on the results of fossil analysis, following five (5) Epoch/Age were confirmed.

Depth(m)	Thickness(m)	Epoch/Age
0-168	168	Turonian
168-310	142	Cenomanian
310-500	190	Lower Cretaceous
500-515	15	Carboniferous
515-557	>42	Cambrian

5) Grain Size Analysis

A total of 13 ditch samples were collected from Lower Cretaceous formation. Collected samples are classified as fine sand to very fine sand. The distributions of permeability coefficient are shown in Table.7.3.5-2. The permeability coefficient estimated by D_{20} is a range between 1.05×10^{-5} cm/sec and 8.9×10^{-3}cm/sec.

6) Pumping Test

(1) Upper Cretaceous Limestone

No aquifer zone was found by well logging, so that aquifer test has not been

performed.

(2) Upper Cretaceous Limestone

Due to the no recovery of the water table, the pumping test have not been carried out.

7.3.6 J-6 (Fig.7.3-6)

1) Lithology

The well drilled up 900m depth. Wadi deposit was observed at the depth from surface to 16m. According to the results of micro fossil analysis and lithology observed, the following seven (7) major layers were classified.

Layer	Depth(m)	Lithology	Epoch/Age
1	16-40	Chalk	Masstrichtian
2	40-180	Claystone	Campanian
3	180-216	Limestone	Santonian-Conician
4	216-290	Limestone intercalated with Claystone and Shale	Turonian
5	290-610	In upper part; Dolmitic Limestone, alternation of Limestone and Shale. In lower part; Sandy Shale	Cenomanian
6	610-795	Sandstone, Shale	Lower Cretaceous
7	795-900	Sandstone, Shale	Jurassic

2) Well Logging

Results of well logging are as follows

Layer	Resistivity (Ω-m)		Gamma Ray(cps)	Spontaneous Potential(mv)	Temperature (°C)
	Short	Long			
1	12-18	4-26	12-32	15143-15157	28.4
2	4-35	3-32	14-129	15005-15914	28.5-29.6
3	3-54	3-59	4-49	15059-15201	29.6-29.9
4	10-55	14-69	5-55	15081-15207	29.9-30.4
5	6-121	3-172	4-61	15062-15720	30.2-33.2
6	30-96	40-132	3-93	15212-15247	32.2-35.1
7	32-75	24-111	6-69	15207-15265	35.1-35.4

3) Determination of Casing Design

Casing design was determined as shown in Fig.7.3-8. The layer consists of mostly sandstone. The length of screen and casing pipes including sand trap are 124.40 m and 62.11 m, respectively.

4) Fossil Analysis

A total of 30 samples were collected from the Upper Cretaceous formation. These

samples includes chalk, claystone, limestone, shale and sandy shale. The results of fossil analysis are presented in Table 7.3.6-1. Based on the results of analysis in this well, seven (7) Epoch/Age were confirmed.

Depth(m)	Thickness(m)	Epoch/Age
16-40	24	Maastrichtian
40-180	140	Campanian
180-216	36	Santonian-Conician
216-290	74	Turonian
290-610	320	Cenomanian
610-795	185	Lower Cretaceous
795-900	>105	Jurassic

5) Grain Size Analysis

A total of 20 ditch samples were collected from Lower Cretaceous formation. Collected samples are classified as silt. The distributions of permeability coefficient are shown in Table.7.3.6-2. The permeability coefficient estimated by D_{20} is 4.9×10^{-5} cm/sec.

6) Pumping Test

(1) Upper Cretaceous Limestone

An aquifer test was performed at the depth between 220m to 260m. The maximum discharge by the airlifting was $11 m^3/h$. Static water level was observed as 15.08m below the ground level. After discharge by airlifting, recovery test were conducted (see Fig.7.3.6-1). Transmissibility and Permeability coefficients were calculated as $9.5 \times 10^{-4} m^2/min$ and $5.3 \times 10^{-4} cm/sec$ respectively.

(2) Lower Cretaceous Sandstone

Constant discharge and recovery test by the airlifting were performed. Analysis data are shown in Fig.7.3.6-2. In stead of submersible pump, airlifting method was applied for the test. Because, static water level was deeper (440m) than the total head capacity of the available pump. The maximum discharge by the airlifting was $9.3 m^3/h$. An aquifer constant was calculated as follows;

Method	Transmissibility T:(m^2/min)	Storage S	Permeability *k*(cm/sec)
Recovery	7.97×10^{-2}	-	1.06×10^{-3}

Radius of Influence was given as the follows;

$R(m)=16.935t^{0.5}$ ($Q=30m^3/h$) t: time of pumping operation(hour)

7.3.7 J-7 (Fig.7.3-7)

1) Lithology

The well was drilled up to 250m depth. The lithology of the sequence is mainly fine to coarse sand of Quaternary deposit. The boulder formation was observed at the depth of 123m to 133m. Loss circulation of drilling fluid was happened in this formation.

2) Well Logging

The results of logging are as follows, and three layers were classified.

Depth (m)	Resistivity (Ω-m)		Gamma Ray(cps)	Spontaneous Potential(mv)	Lithology
	Short	Long			
0-35	100>	100>	70-110	7950-7970	Fine to Medium Sand with fragments of granite
35-140	20-40	20-60	50-100	7980-8010	Medium to Coarse Sand with fragments of granite
140-250	20-30	20-30	100-160	8000-8020	Fine to Medium Sand with fragments of granite

3) Determination of Casing Design

Casing design was determined as shown in Fig.7.3-8. The length of screen and casing pipes including sand trap are 40 m and 20 m, respectively.

4) Pumping Test

Constant discharge and Recovery test were performed. The results of the test shows Fig.7.3.7-1. The maximum discharge rate was 6.0 m^3/h. An aquifer constant was calculated as follows;

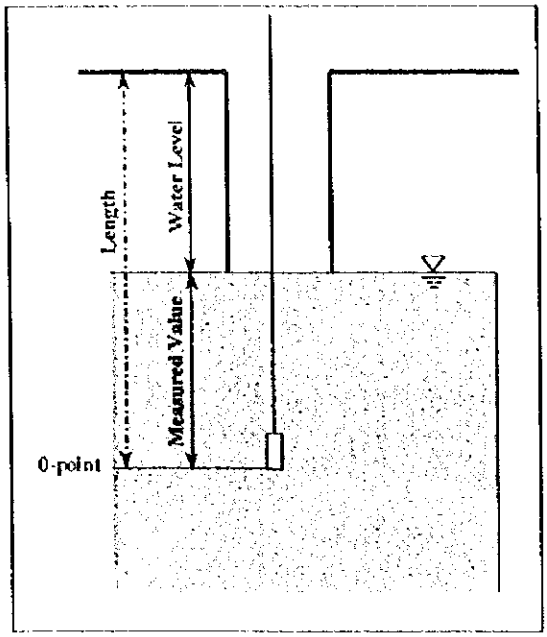
Method	Transmissibility T:(m^2/min)	Storage S	Permeability *k*(cm/sec)
Recovery	6.81×10^{-4}	-	1.14×10^{-3}

Radius of Influence was given as follows;

$R(m)=1.6733t^{0.5}$ ($Q=6m^3/h$) t : time of pumping operation(hour)

7.4 Installation of Water Level Gauge

Water level gauges are installed in J-1, J-2, J-3, J-4, and J-6. Water level values are measures by means of oil-free ceramic reference-pressure measuring cell which senses the water pressure. And further, the measured values are stored in the data logger which is built into the body of the pressure probe. Outline of this water level gauge is shown below:



Length

J-1: 337.61m

J-2: 442.89m

J-3: 304.47m

J-4: 518.69m

J-6: 457.12m

To find the value of Instantaneous Water Level, Length which is listed above and Measured Value are necessary. Relationship among measured value, length and (instantaneous) water level is as follows:

Instantaneous Water Level = Length – Measured Value

Meavsuring /storing interval of each well is sat up at one-hour interval and stored data is downloaded every three months.

7.5 Consideration

In summary, results of test well drilling and pumping test are as follow;

Depth and thickness of the formation

Epoch	Age	J-1		J-2		J-3		J-4		J-5		J-6	
		Depth	Thick	Depth	Thick	Depth	Thick	Depth	Thick	Depth	Thick	Depth	Thick
Holocene		10	10	20	20	0	0	30	30	0	0	16	16
Eocene		0	0	263	243	0	0	80	50	0	0		0
Paleocene		40	30	303	40	0	0	112	32	0	0		0
Upper Cretaceous	Maastrichian	180	140	443	140	60	60	252	140	0	0	40	24
	Campanian	290	110	563	120	229	169	380	128	0	0	180	140
	Santonian-Coniacian	385	95	619	56	301	72	448	68	0	0	216	36
	Turonian	520	135	770	151	495	194	594	146	168	168	290	74
	Cenomanian	865	345	1050	280	771	276	845	251	310	142	610	320
Lower Cretaceous	Albian-Aptian	1110	245	1260	210+	1000	229+	1106	261	500	190	795	185
Jurassic		1254	144+					1130	24+	515	15	900	105+
Cambrian										557	42+		

Water level of Lower Cretaceous and Upper Cretaceous

Well No	Elevation	Water Level			
		Lower Cretaceous		Upper Cretaceous	
	(A.S.L m)	(m.BGL)	(m.ASL)	(m.BGL)	(m.ASL)
J-1	520	317.0	203	71.08	449
J-2	657	424.0	233	-	-
J-3	544	284.0	260	-3.3	547
J-4	775	501.0	274	-	-
J-5	740	dry	-	-	-
J-6	710	440.0	270	15.08	695
J-7	285	BGL148.99m, ASL 136.01m (Quaternary sand)			

Aquifer constants of Lower Cretaceous Sandstone

Well No.	Q (m^3/day)	Transmissibility (m^2/min)	Storage	Permeability (cm/sec)	Ew (%)
J-1	800	$1.48\text{-}2.72\times10^{-1}$	1.77×10^{-8}	$1.52\text{-}2.8\times10^{-2}$	95
J-2	700	$2.41\text{-}2.65\times10^{-2}$	$6.1\times10^{-4}\text{-}1.02\times10^{-3}$	$1.45\times10^{-3}\text{-}1.57\times10^{-2}$	99
J-3	900	$1.34\text{-}2.29\times10^{-1}$	1×10^{-8}	$1.5\text{-}2.56\times10^{-3}$	96
J-4	264*	1.38×10^{-2}	-	1.69×10^{-4}	-
J-5	-	-	-	-	-
J-6	223*	7.97×10^{-2}	-	1.06×10^{-3}	-
J-7	144	6.18×10^{-4}		1.14×10^{-3}	

* by airlifting

Table.7.3.1-1 Micro-Fossil Analysis(J-1)

Depth (m)	Lithology	Fossil	Age
(2-40) m	Marly Limestone	*Morozovella velasconesis*	Paleocene
	White Limestone	*Morozovella angulata*	(Early-Middle-Late)
	Dark green Shale	*Morozovella pseudobuuoides*	
(40-180) m	Halky Limestone	*Bolovinoides draco draco*	Maastrichtian
	Chalk and some chert	*Globotruncana aegypetiaca*	(Early-Middle-Late)
(180-296) m	Brownish Clay	*Globorotalites conicus*	Campanian
	Argilaceous Limestone	*Rostita fornicata*	(Early-Middle-Late)
	Phosphatic Limestone	*Globotruncanita elvata*	
(300-385) m	Chalky Limestone	*Dicarinella concavata*	Coniacian-Santonian
	Gluconite	*Dicarinella asymmetrica*	(Early-Middle-Late)
	Sandy Limestone	*Heterohelix globulosa*	
	Calcareous Clay	*Discorbis bakrensis*	
(385-490) m	White Limestone	*Discorbis turonicus*	Turonian
	Oolitic Limestone	*Heterohelix reussi*	(Early-Middle-Late)
	Sandy Limestone	*Whetinella archeacretacea*	
(556-861) m	Calcareous Clay	*Ostracoda spp*	Cenomanian
	Limestone	*Hedbergella spp*	(Early-Middle-Late)
	Gluconite	*Nazzazta simplex*	
	Dolomitic Limestone	*Thomastinella aegyptiaca*	
	Oolitic Limestone	*Thomastinella punica*	
	Shale	*Doxia cenomani*	
(865-1126) m	Sandsone with some Shale	*Flabellaminia spp*	Early Cretaceous
		Ostracoda sp	(Apt.-Alb.)
		Arenoceous formis	
(1130-1250)	Coal-Black Shale	Unfossiliferous	Jurassic
	Sandstone		

Table7.3.1-2 D_{20} and Estimated Permeability (J-1)

No.	Depth (m)	D_{20} (mm)	Permeability (cm/sec)	Classification
1	1034-1036	-	-	
2	1040-1042	-	-	
3	1046-1048	-	-	
4	1052-1054	-	-	
5	1058-1060	-	-	
6	1064-1066	-	-	
7	1070-1072	0.125	2.90×10^{-3}	Fine Sand
8	1076-1078	0.125	2.90×10^{-3}	Fine Sand
9	1082-1084	0.125	2.90×10^{-3}	Fine Sand
10	1088-1090	0.125	2.90×10^{-3}	Fine Sand
11	1094-1096	0.125	2.90×10^{-3}	Fine Sand
12	1100-1102	-	-	
13	1106-1108	-	-	
14	1112-1114	-	-	

Table.7.3.2-1 Micro-Fossil Analysis (J-2)

Depth (m)	Lithology	Fossil	Age
(23-132) m	Chalky limestone & chert	*Truncorotaliodes rohri* *Acarinina Pentacamerata* *Nummulites spp* *Morozovella aragonensis* *Acarinina bullbrooki*	Middle Eocene
(142-242) m	Hard white limestone, chalky limestone and some chert	*Alveolina sp* *Acarinina soldadoensis* *Acarinina Pentacamerata* *Morozovella subbotina* *Morozovella formosa formosa* *Morozovella aragonensis*	Lower Eocene
(252-271) m	Chalky limestone and some shale	*Morozovella velascoensis* *Morozovella angulata* *Morozovella subbotina* *Planorotaloides pseudomenardii* *Acarinina mckanni* *Acarinina soldadoensis*	Late Paleocene
(271-293) m	Clay to shale	*Morozovella pseudobulloides* *Morozovella trinidadensis* *Globigerina triloculinoides* *Globigerina fringa*	Early Paleocene
(305-453) m	Chalky limestone and some chert, clay	*Bolivinoides draco draco* *Globotruncana aegyptiaca* *Globotruncana arca* *Gansserina gansseri* *Bolovina incrassata* *Globotruncanita stuarti formis*	Maastrichtian (Early-Middle-Late)
(453-556) m	clay, calcareous claystone, phosphatic band (dark brown)	*Globotruncanita falsostuarti* *Globotruncanita calcarata* *Globorotaloides conicus* *Globotruncana arca*	Campanian (Early-Middle-Late)
(560-619) m	White,chalky limestone and sandy limestone	*Dicarinella concavata* *Dicarbis turonica* *Dicarinella asymmetrica*	Coniacian-Santonian
(626-7799 m	White limestone, oolitic limestone, dolomitic limestone and sandy limestone	*Dicarbis turonicus* *Ostracoda spp* *Dicarbis minute* *Heterohelix reussi* *Whitenella archo cretacea* *Marginotruncoa sigali* *Marginotruncana marginata* *Hedbergella delrioensis*	Turonian (Early-Middle-Late)
(779-823) m	Shale or clay (Dark brown)	*Hedbergella delrioensis* *Ostracoda spp* *Cytherella sp* *Heterohelix reussi*	Latest Cenomanian to Earliest Turonian

Table.7.3.2-2 D_{20} and Estimated Permeability(J-2)

No.	Depth (m)	D_{20} (mm)	Permeability (cm/sec)	Classification
1	1106-1107	0.19	8.90×10^{-3}	Fine Sand
2	1116-1117	-	-	
3	1121-1122	1.10	3.60×10^{-1}	V.Coarse Sand
4	1151-1152	0.37	3.20×10^{-2}	Medium Sand
5	1153-1154	0.90	2.80×10^{-1}	Coarse Sand
6	1156-1157	0.90	2.80×10^{-1}	Coarse Sand
7	1162-1163	0.40	4.50×10^{-2}	Medium Sand
8	1167-1168	1.10	3.60×10^{-1}	V.Coarse Sand
9	1172-1173	0.18	6.85×10^{-3}	Fine Sand
10	1178-1179	0.73	1.60×10^{-1}	Coarse Sand
11	1179-1180	-	-	-
12	1182-1183	0.42	4.50×10^{-2}	Medium Sand
13	1187-1188	0.35	3.20×10^{-2}	Medium Sand
14	1191-1191	0.50	7.50×10^{-2}	Medium Sand
15	1197-1198	1.30	3.60×10^{-1}	V.Coarse Sand
16	1202-1203	0.91	2.80x10-1	Coarse Sand
17	1207-1208	1.60	1.80	V.Coarse Sand
18	1210-1213	1.45	3.60×10^{-1}	V.Coarse Sand
19	1216-1217	0.37	3.20×10^{-2}	Medium Sand
20	1219-1220	-	-	-
21	1247-1248	0.82	2.15x10-1	Coarse Sand

Table.7.3.3-1 Micro-Fossil Analysis (J-3)

Depth (m)	Lithology	Fossil	Age
(2-80) m	Calky limestone, chert and clay in the base	*Globotruncana aegypetiaca* *Globotruncana fornicata* *Bolivinoides draco draco* *Globotruncantia stuartiformis* *Globotruncana arca*	Maastrichtian (Early-Middle-Late)
(80-234) m	Dark brown calcareous claystone and phosphatic beds	*Globorotaloides conicus* *Globotruncana arca* *Globotruncantia falsostuarti* *Globotruncana fornicata*	Campanian (Early-Middle-Late)
(241-300) m	Chalky limestone, sandy limestone, chert and white sandy marly limestone	*Dicarinella concavata* *Discorbis turonicus* *Heterohelix globulosa* *Marginotruncana sp* *Ostracoda sp*	Conacian-Santonian
(303-470) m	Oolitic limestone, clay in the base, marly limestone and sandy limestone, some gluconite occurance in these samples	*Discorbis turonicus* *Ostracoda spp* *Marginotruncana sp*	Turonian (Early-Middle-Late)
(490-771) m	Oolitic limestone, dolomitic limestone, Sandy shale, shally sand, sandstone (calcareous) pyrite, gluconite, and some Sand	*Heterohelix spp* *Hedbergella sp* *Ostracoda sp* *Cytherella sp* *Thomosinella aegyptiaca* *Nazzazata aegyptiaca* *Flabellammina aegyptiaca* *Arenaceous formis* *Daxia cenomana*	Cenomanian (Early-Middle-Late)
(781-800) m	Sandstone, well sorted, well rounded, well mature	*Unfossiliferous*	May be Early Cretaceous (Albian)

Table 7.3.3-2 D_{20} and Estimated Permeability(J-3)

No.	Depth *(m)*	D_{20} *(mm)*	Permeability *(cm/sec)*	Classification
1	780-781	-	-	-
2	787-788	-	-	-
3	788-789	-	-	-
4	789-790	-	-	-
5	799-800	-	-	-
6	805-806	0.13	3.80×10^{-3}	Fine Sand
7	814-815	0.13	3.80×10^{-3}	Fine Sand
8	820-821	0.16	5.10×10^{-3}	Fine Sand
9	830-831	0.15	5.10×10^{-3}	Fine Sand
10	841-842	0.17	6.85×10^{-3}	Fine Sand
11	845-846	0.15	5.10×10^{-3}	Fine Sand
12	848-849	0.17	6.85×10^{-3}	Fine Sand
13	864-865	0.15	5.10×10^{-3}	Fine Sand
14	869-870	-	-	-
15	876-877	-	-	-
16	884-885	-	-	-
17	896-897	0.08	9.00×10^{-4}	V.Fine Sand
18	906-907	0.08	9.00×10^{-4}	V.Fine Sand
19	918-919	-	-	-
20	924-925	-	-	-
21	932-933	-	-	-
22	946-947	-	-	-
23	951-952	-	-	-
24	960-961	0.11	1.75×10^{-3}	V.Fine Sand
25	965-966	0.27	2.20×10^{-2}	Medium sand
26	970-971	-	-	-
27	980-981	-	-	-
28	987-988	-	-	-
29	992-993	-	-	-
30	1002-1003	-	-	-

Table.7.3.4-1 Micro-Fossil Analysis(J-4)

Depth (m)	Lithology	Fossil	Age
(0-88) m	Chalky Limestone with some chert	*Acarinina soldadoensis* *Acarinina Pentacamerata* *Morozovella formosa* *Morozovella aragoensis* *Acarinina angulosa*	Early Eocene
(88-118) m	Marly Limestone Chalky Limestone	*Morozovella velascoensis* *Morozovella pseudobulloides* *Morozovella angulata*	Paleocene (Late-Middle-Early)
(118-278) m	Chalk Chert some clay	*Globotruncana aegyptiaca* *Ganssarina gansseria* *Bolivinoides drocodraco* *Pluorotaloites pseudomenardii*	Maastrichtian
(278-388) m	Calc.claystone Chert Phosphatic Limestone	*Globorotaloides conicus* *Rostia fornicata* *Globorruncana area*	Campanian (Early-Middle-Late)
(388-448) m	White chalk Gluconite Arg. Limestone	*Dicarinella concavata* *Dicarinella asymmetrica* *Rostia fornicata* *Discorbis bakrensis*	Conacian-Santonian (Early-Middle-Late)
(448-628) m	dolomitic limestone Oolitic limestone Sandy limestone	*Discorbis huronicus* *Heterohelix reussi* *Whetinella sp*	Turonian (Early-Middle-Late)
(628-838) m	Calc.shale Marly Limestone Silic. Limestone dolomitic limestone Chert Shale	*Ostracoda spp* *Heterohelix reussi* *Whitenella archeocretacea* *Thomasinella aegyptiaca* *Thomasinella rugosa* *Doxia cenomani*	Cenomanian (Late-Middle-Early)
(838-1108)m	Sandstone Reddish clay Gravel	*Flabellamina spp.* *Ostracoda sp* *Ammobaculites spp*	Lowercretaceous (Apt-Alb.)
(1108-1130) m	Black shale Gravelly sand	*Arenaceous formis* *fossil plants*	Jurassic (Bajocian)

Table.7.3.4-2 D_{20} and Estimated Permeability (J-4)

No.	Depth (m)	D_{20} (mm)	Permeability (cm/sec)	Classification
1	850-851	0.11	2.6×10^{-3}	Fine Sand
2	851-852	0.15	5.1×10^{-3}	Fine Sand
3	852-854	0.07	6.5×10^{-4}	Very Fine Sand
4	854-856	0.07	6.5×10^{-4}	Very Fine Sand
5	856-858	0.05	2.8×10^{-4}	Silt
6	878-880	0.05	2.8×10^{-4}	Silt
7	918-920	0.06	4.6×10^{-4}	Very Fine Sand
8	920-922	0.06	6.5×10^{-4}	Very Fine Sand
9	940-942	0.06	4.6×10^{-4}	Very Fine Sand
10	985-986	0.054	2.8×10^{-4}	Silt
11	988-989	0.05	2.8×10^{-4}	Silt
12	993-994	0.05	2.8×10^{-4}	Silt
13	996-998	0.05	2.8×10^{-4}	Silt
14	999-1000	0.06	4.6×10^{-4}	Very Fine Sand
15	1006-1008	0.051	2.8×10^{-4}	Very Fine Sand
16	1028-1030	0.09	1.4×10^{-3}	Very Fine Sand
17	1030-1032	0.09	1.4×10^{-3}	Very Fine Sand
18	1043-1045	0.04	1.75×10^{-4}	Silt
19	1045-1047	0.04	1.75×10^{-4}	Silt
20	1050-1052	0.024	4×10^{-5}	Silt
21	1052-1054	0.09	1.4×10^{-3}	Very Fine Sand
22	1066-1068	0.17	6.85×10^{-3}	Fine Sand
23	1068-1070	0.13	3.8×10^{-3}	Fine Sand

Table.7.3.5-1 Micro-Fossil Analysis(J-5)

Depth (m)	Lithology	Fossil	Age
(0-168) m	Dolomitic Limestone and Limestone	*Discorbis turonicus* *Discorbis minuta* *Nazzazatinella sp* *Marginotruncana sigali* *Heterohelix moremani*	Turonian (Middle-Late)
(168-220) m	Calc.Shale Marly Limestone Clay	*Heterohelix reussi* *Whetinellaarchaeocretacea* *Ostracoda*	Turonian (Early to late Cenomanian)
(220-310) m	Dolomitic Limestone Sandy Limestone Oolitic Limestone	*Thomasinella aegyptia* *Oster spp* *Nazzazata sp* *Rotaliopora sp*	Cenomanian (Middle-Late)
(310-498) m	Sandstone Gravelly sand Paleosoil(red claystone)	*Flabellaminia spp* *Ammobaculites sp* *Arenaceous fauna* *Ostrocoda sp*	Lower Cretaceous (Aptian-Albian)
(498-504) m	Dolomitic Limestone Limestone Fossil. Limestone	*Spiriferes sp.* *Crinoides stemes* *Productus sp.*	Carbonuferous (Late)
(504-552) m	Gravelly sand Sandstone	*Barren*	Cambrian (Middle-Late)

Table.7.3.5-2 D_{20} and Estimated Permeability(J-5)

No.	Depth (m)	D_{20} (mm)	Permeability (cm/sec)	Classification
1	372-375	0.048	2.8×10^{-4}	Fine Sand
2	396-400	0.061	4.6×10^{-4}	Fine Sand
3	404-406	0.038	2.8×10^{-4}	Fine Sand
4	410-412	0.028	8.5×10^{-5}	Fine Sand
5	416-418	0.0095	1.05×10^{-5}	Fine Sand
6	422-424	0.0095	1.05×10^{-5}	Fine Sand
7	428-430	0.038	2.8×10^{-4}	Fine Sand
8	434-436	0.038	2.8×10^{-4}	Fine Sand
9	440-442	0.068	6.5×10^{-4}	Very Fine Sand
10	446-448	0.068	6.5×10^{-4}	Very Fine Sand
11	476-478	0.068	1.05×10^{-5}	Very Fine Sand
12	488-490	0.012	1.05×10^{-5}	Very Fine Sand
13	494-496	0.22	8.9×10^{-3}	Fine Sand

Table.7.3.6-1 Micro-Fossil Analysis(J-6)

Depth (m)	Lithology	Fossil	Age
(0-2) m	Marly Limestone and Limestone	*Morozovella velascoensis* *Morozovella spp*	Paleocene (Late-Middle)
(2-90) m	Chalky Limestoe Chalk Chert	*Globotruncana aegyptiaca* *Globotruncana arca* *Gansserina gansseria* *Globorotaloides comicus*	Campanian-Maastrichtian (Middle-Late-Late Campanian)
(90-130) m	Yellowish to White Sandstone	Barren Gluconite	Conacian-Santonian (Undifferentiated)
(130-480) m	Dolomitic Limestone Marly Limestone Shelly Limestone Oolitic Limestone	*Hedbergella delrioensis* *Discorbis turonicus* *Heterohelix reussi* *Whiteinella sp* *Thomosinella sp* *Thomosinella aegyptiaca*	Turonian-Cenomanian (Late-Middle-Early)
(480-810) m	Sand stone with some shale and Limestone	*Ostracoda sp* *Gluconite* *Arenaceous formis*	Lower Cretaceous (Early-Middle-Late)
(810-900) m	Luny Clay Sandstone	*Annobaculites sp* *Astacolus sp*	Jurassic (Early)

Table 7.3.6-2 D_{20} and Estimated Permeability (J-6)

No.	Depth (m)	D_{20} (mm)	Permeability (cm/sec)	Classification
1	590-592	-	-	
2	594-596	-	-	
3	606-608	-	-	
4	612-614	-	-	
5	616-618	-	-	
6	618-620	-	-	
7	622-624	-	-	
8	628-630	-	-	
9	634-636	-	-	
10	642-644	-	-	
11	646-648	-	-	
12	650-652	-	-	
13	676-678	-	-	
14	682-684	-	-	
15	714-716	0.022	4.9×10^{-5}	Silt
16	722-724	-	-	
17	776-778	0.022	4.9×10^{-5}	Silt
18	792-794	0.022	4.9×10^{-5}	Silt
19	798-800	-	-	
20	802-806	-	-	

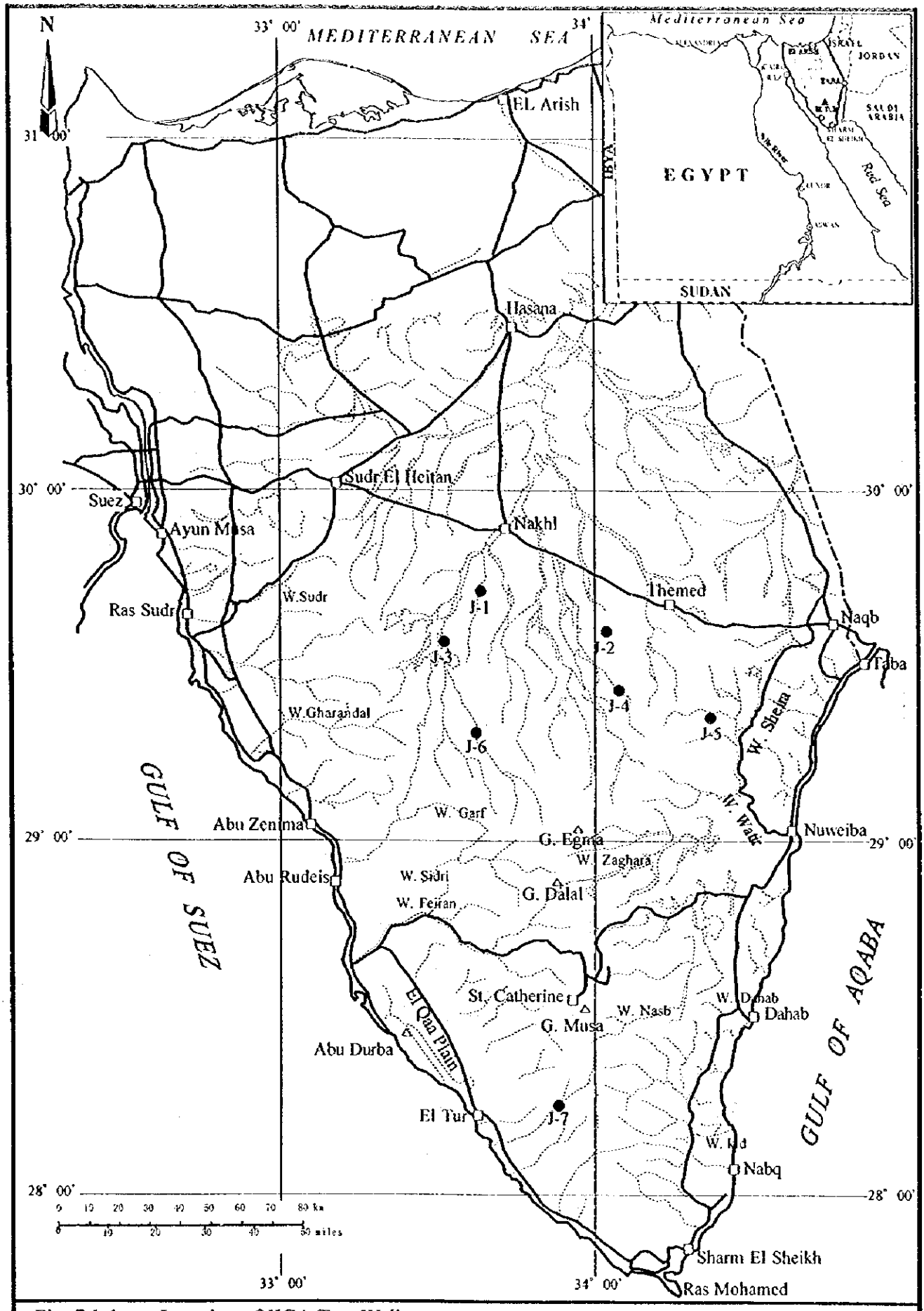


Fig. 7.1-1 Location of JICA Test Well

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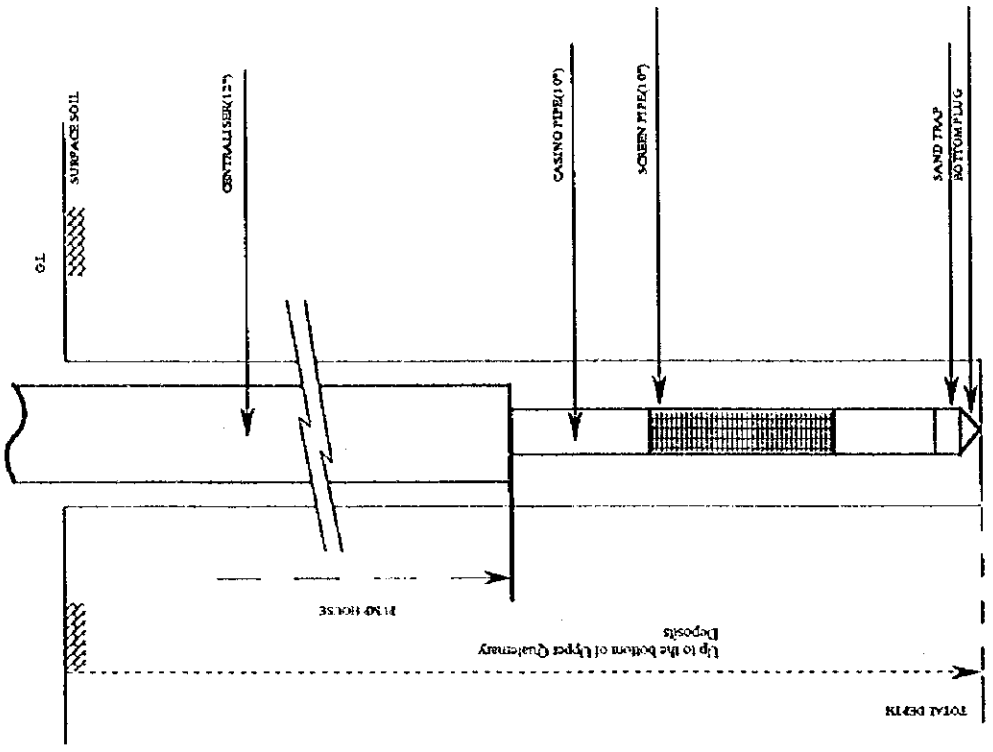
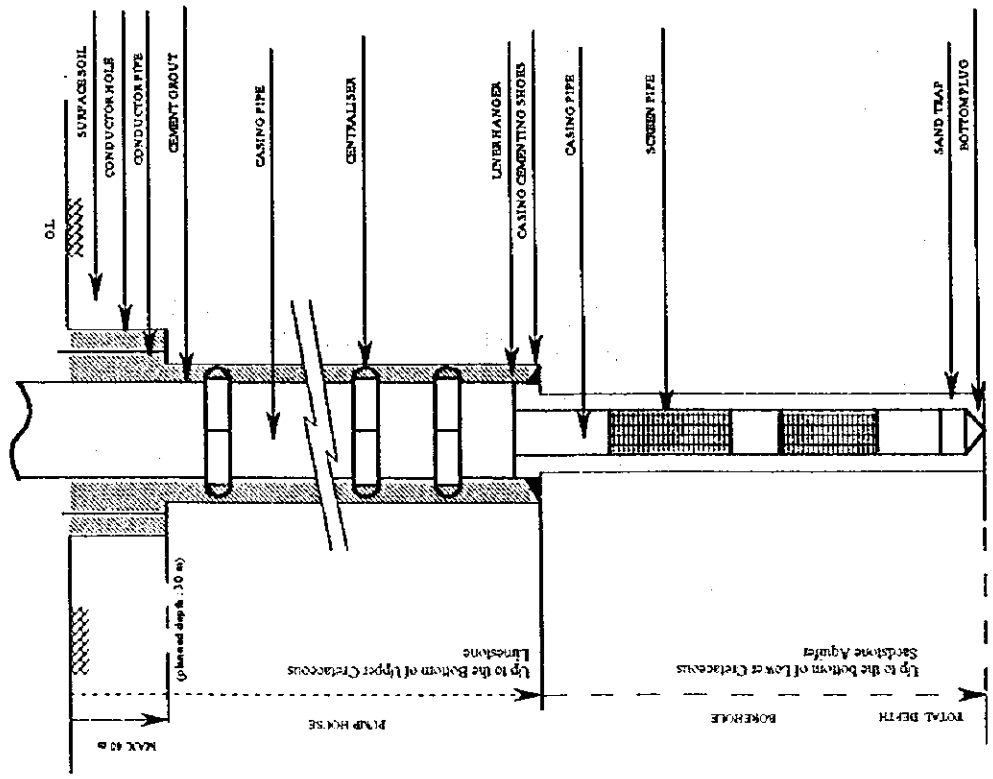


J-7



J-1-6

Fig. 7.2.1-1 Standard Desigh of Wells

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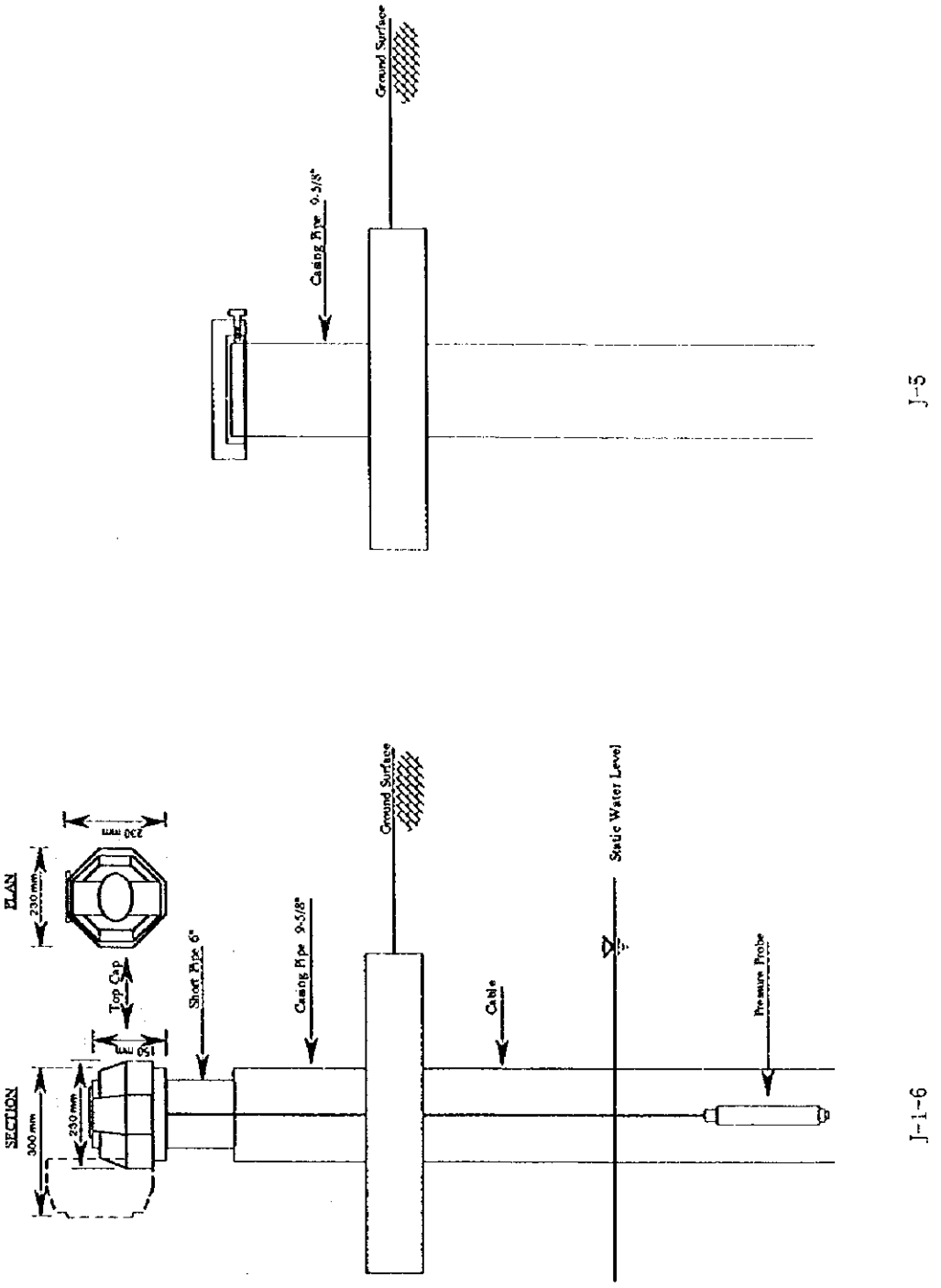
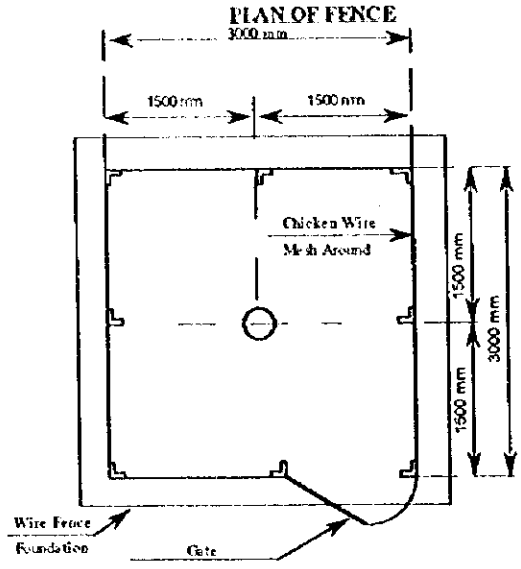


Fig. 7.2.1-2 Well Head and Cap



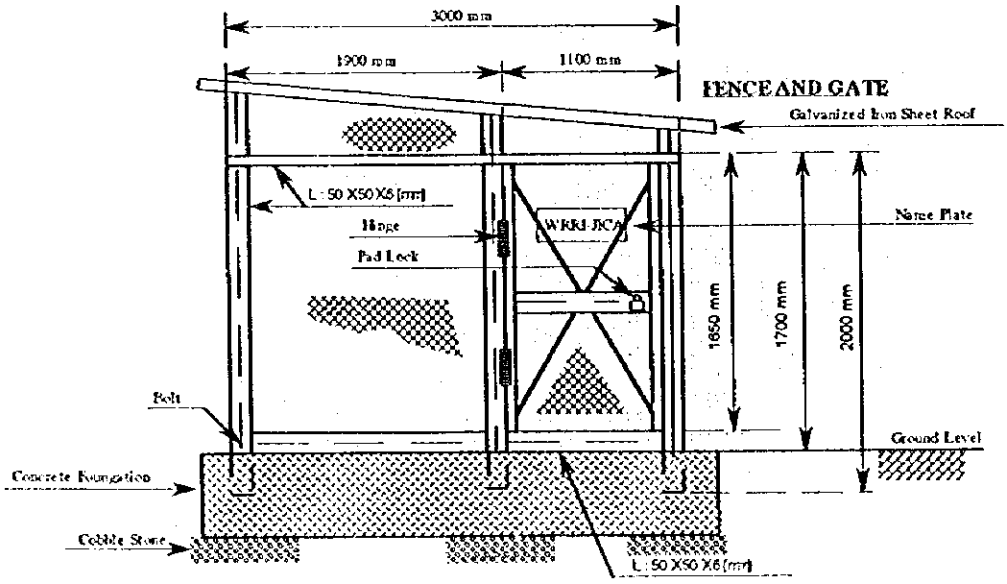


Fig. 7.2.1-3 Well Head Facilities

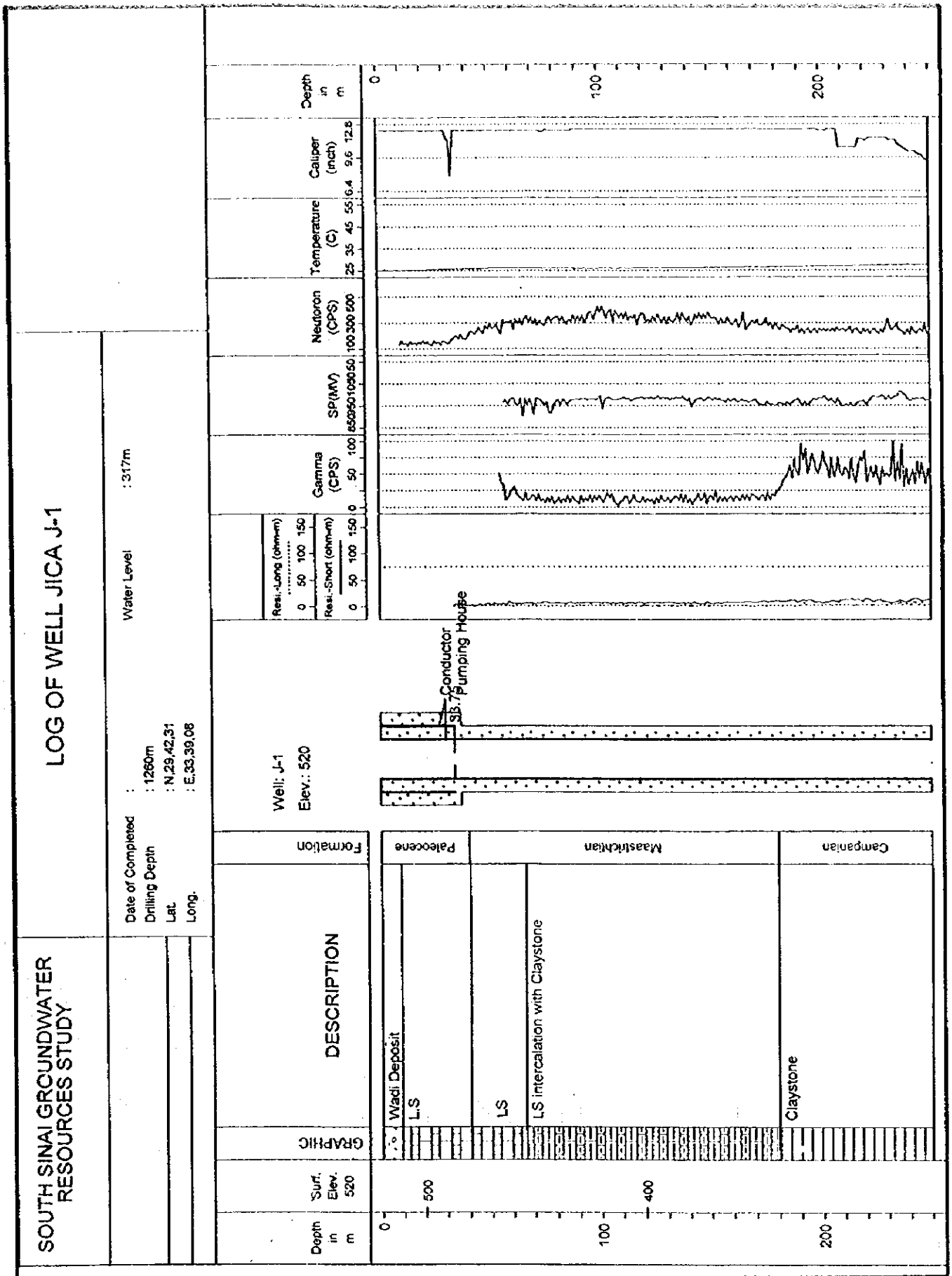


Fig. 7.3-1 Lithological Column (J-1) (Sheet 1 of 5)

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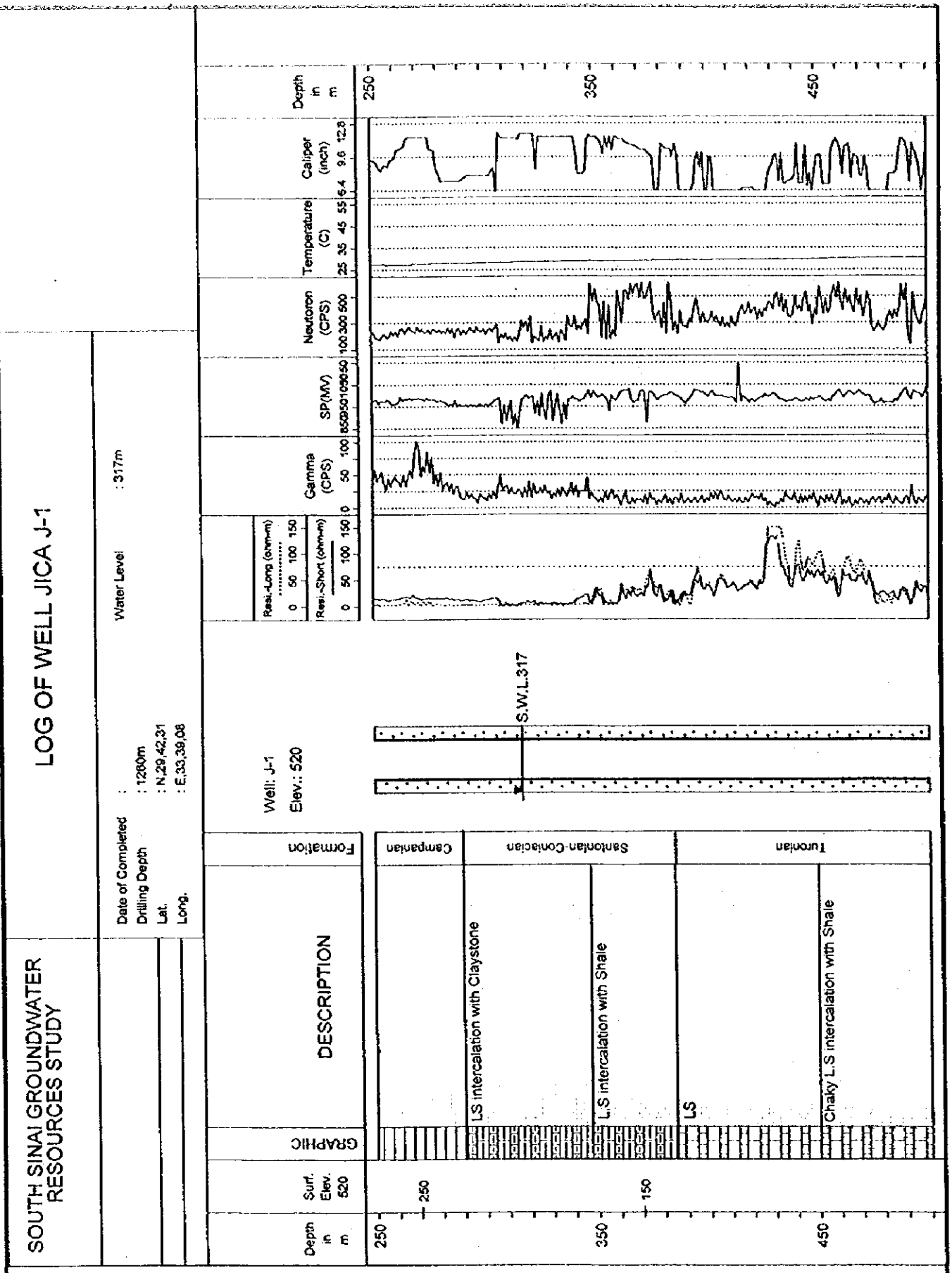

Fig. 7.3-1 Lithological Column (J-1) (Sheet 2 of 5)

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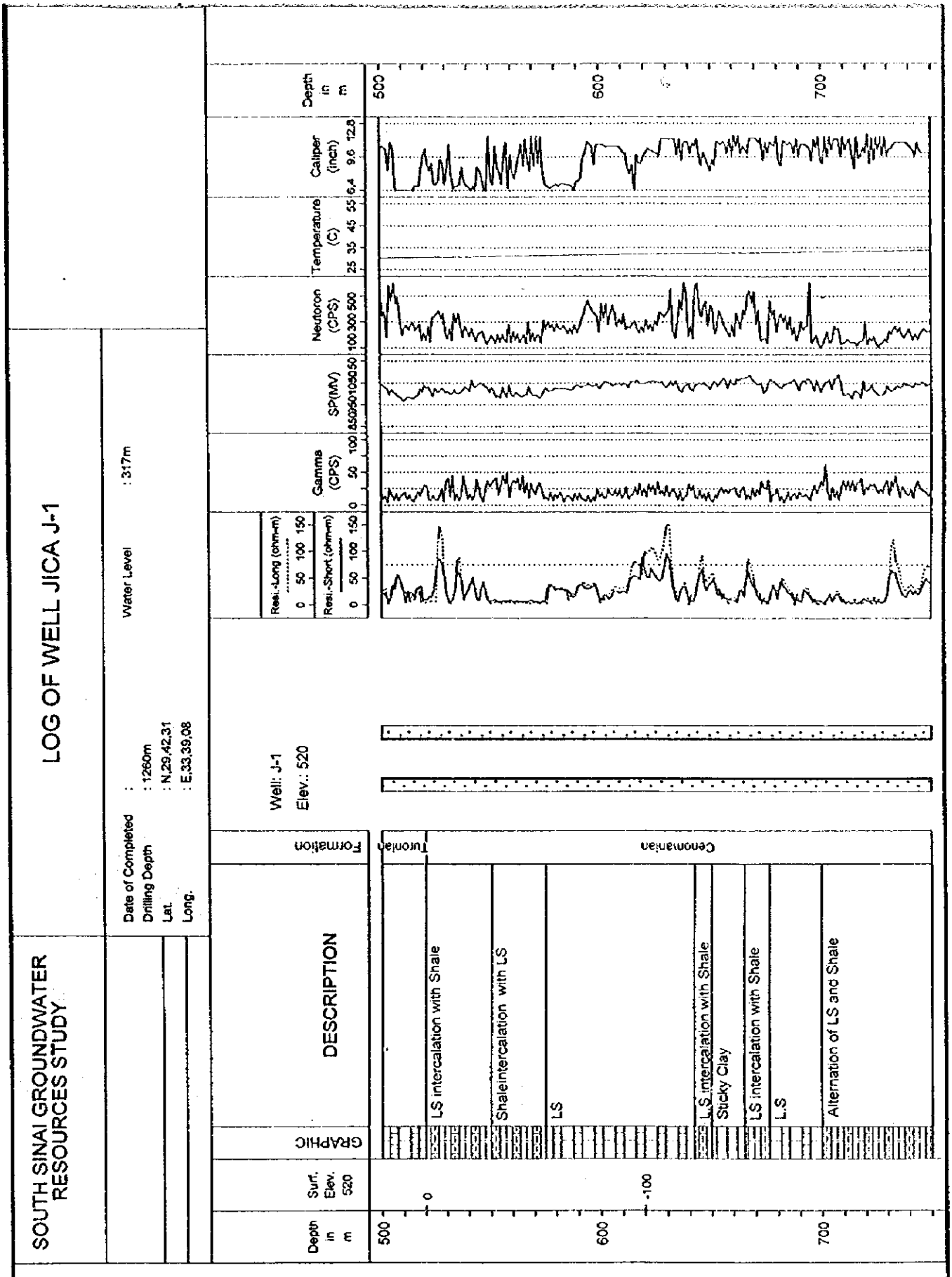

Fig. 7.3-1 Lithological Column (J-1) (Sheet 3 of 5)

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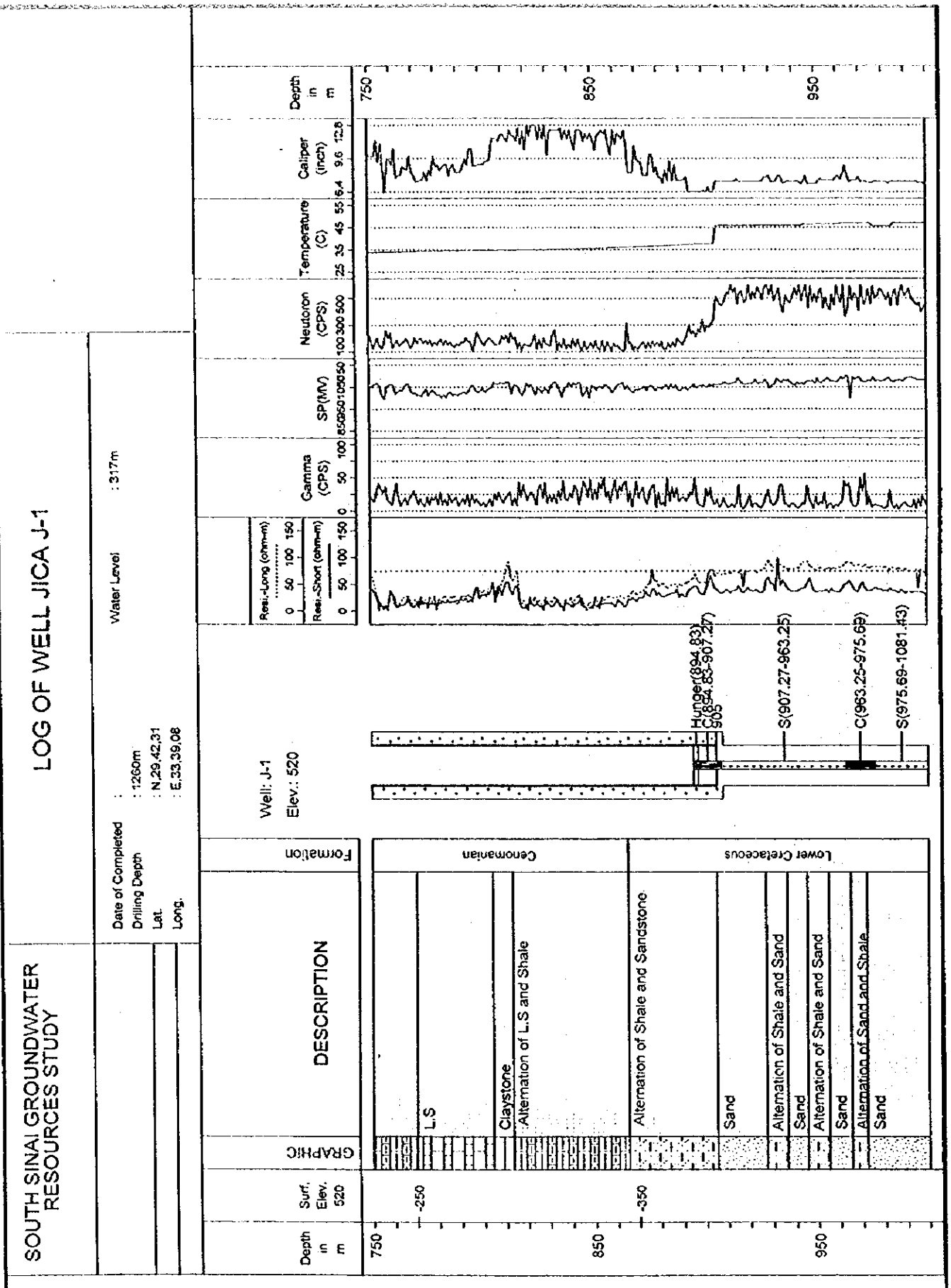

Fig. 7.3-1 Lithological Column (J-1) (Sheet 4 of 5)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

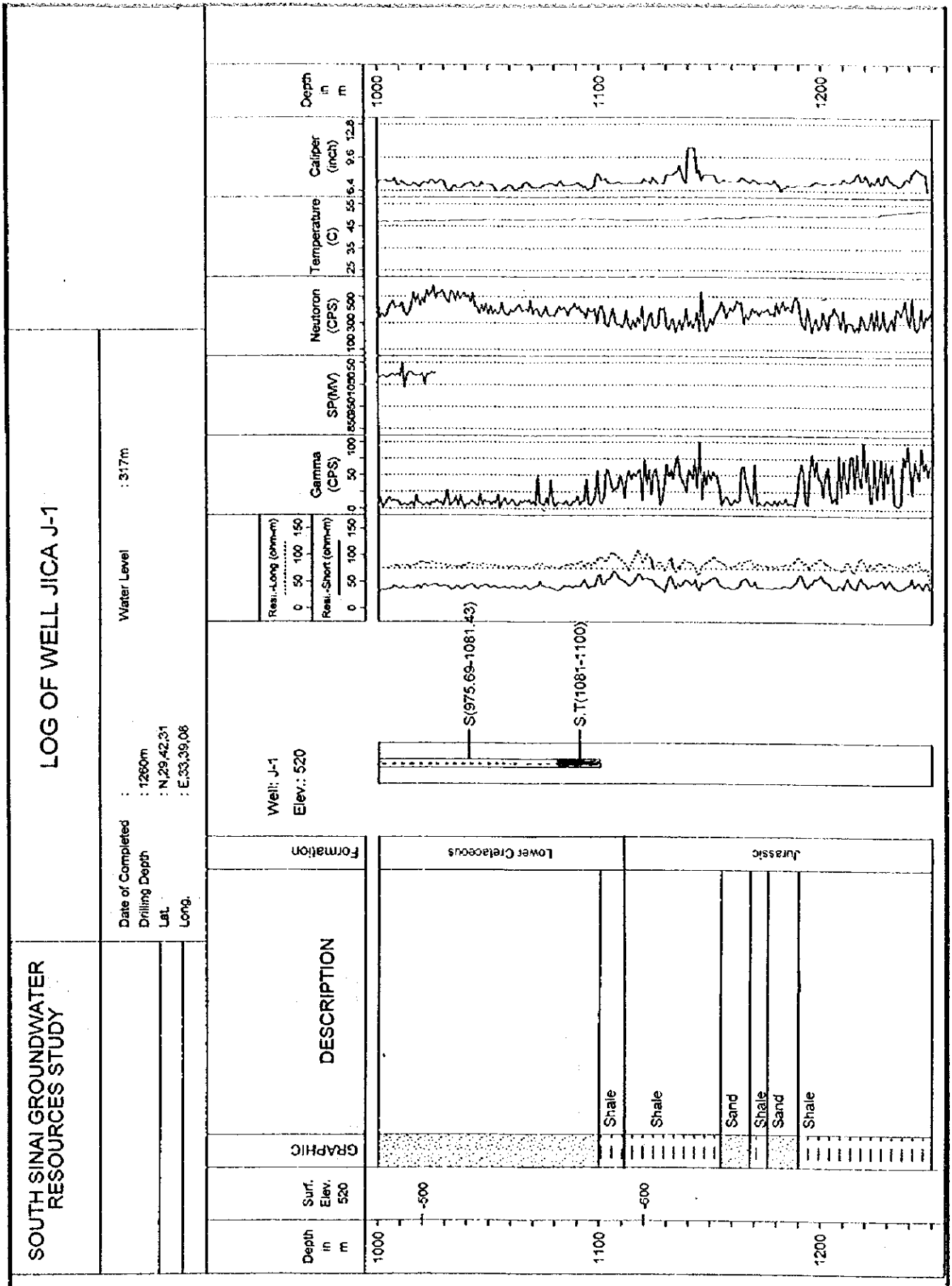

Fig. 7.3-1 Lithological Column (J-1) (Sheet 5 of 5)

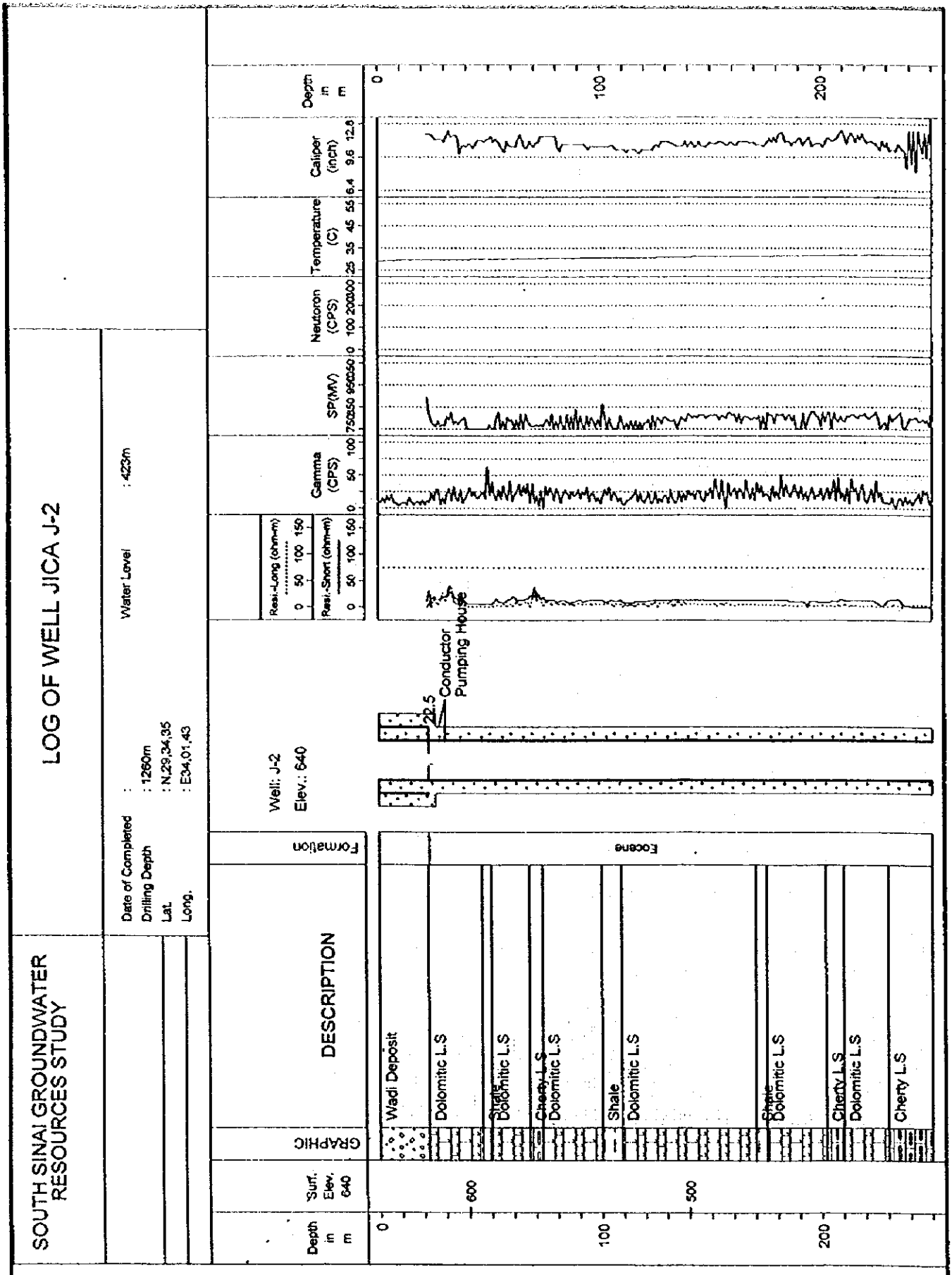

Fig. 7.3-2 Lithological Column (J-2) (Sheet 1 of 6)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

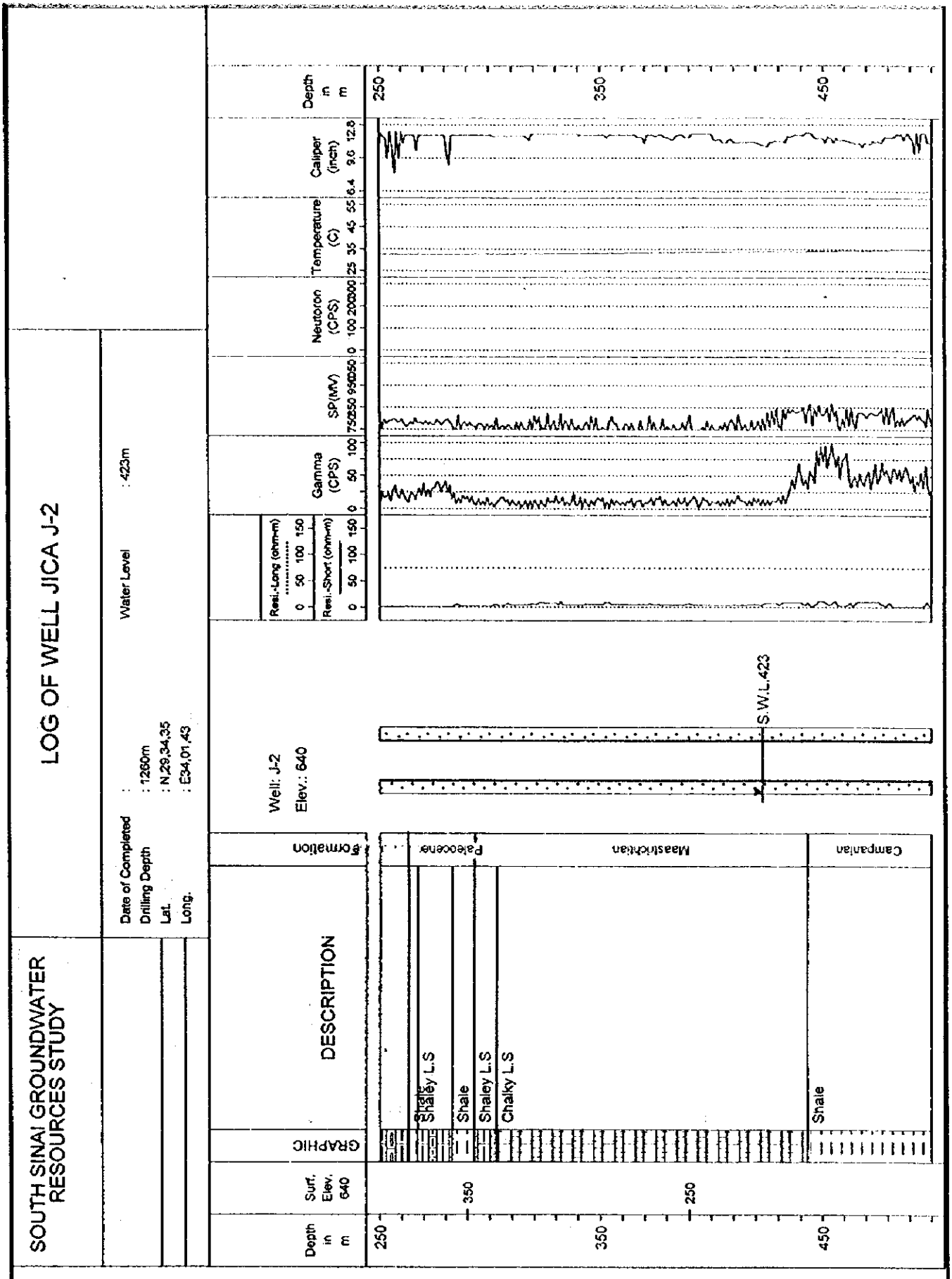

Fig. 7.3-2 Lithological Column (J-2) (Sheet 2 of 6)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

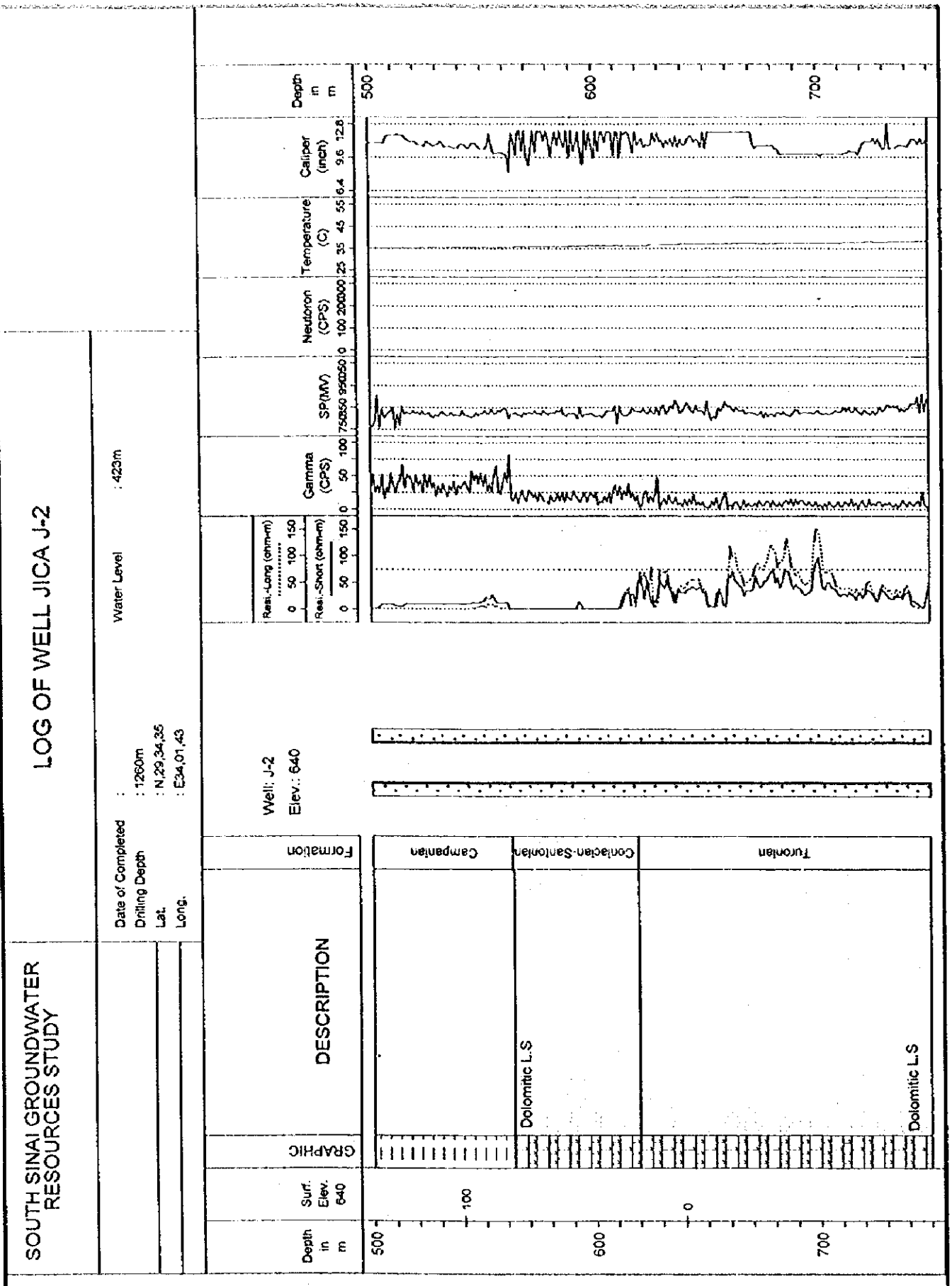

Fig. 7.3-2 Lithological Column (J-2) (Sheet 3 of 6)

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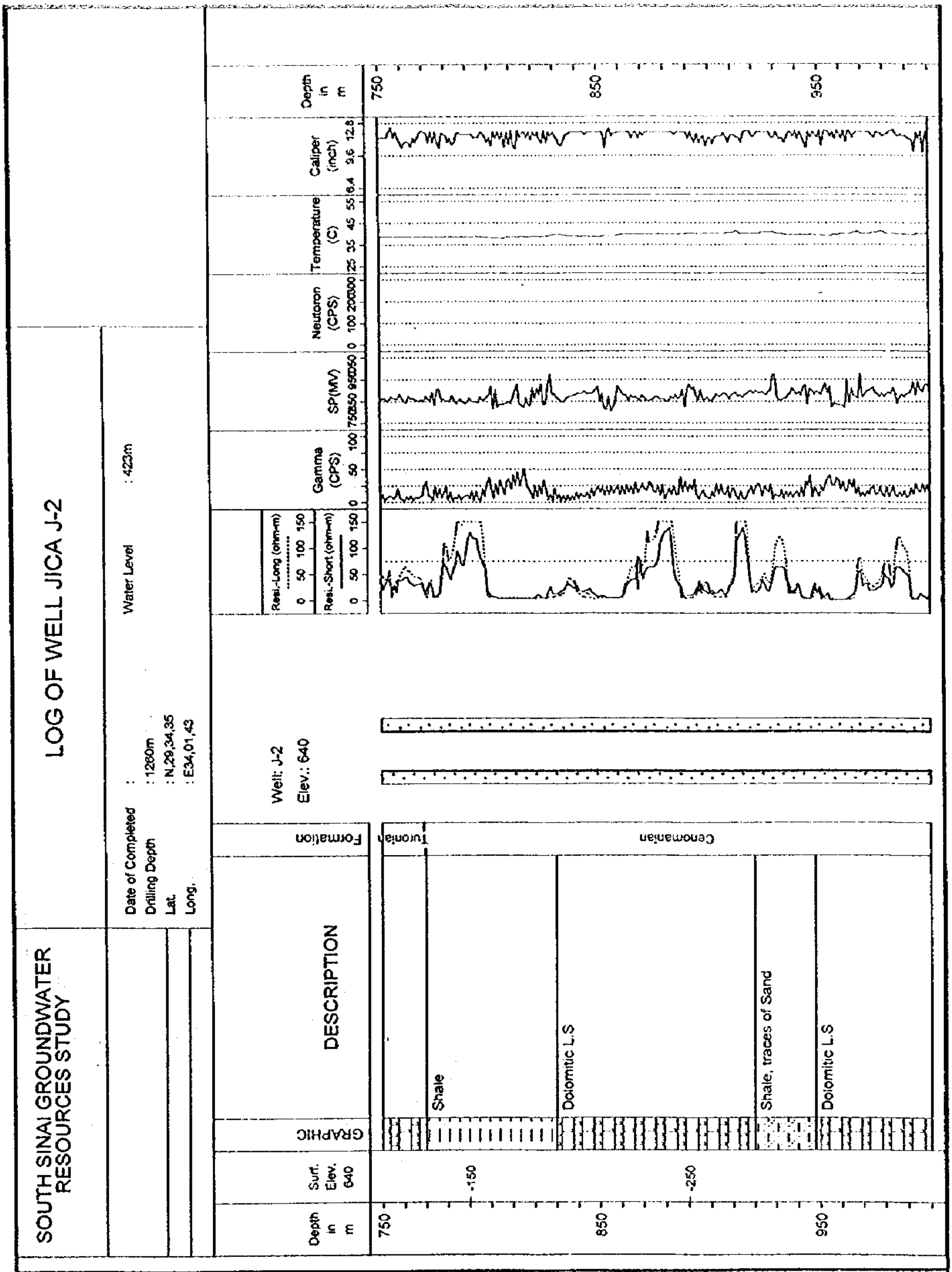


Fig. 7.3-2 Lithological Column (J-2) (Sheet 4 of 6)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

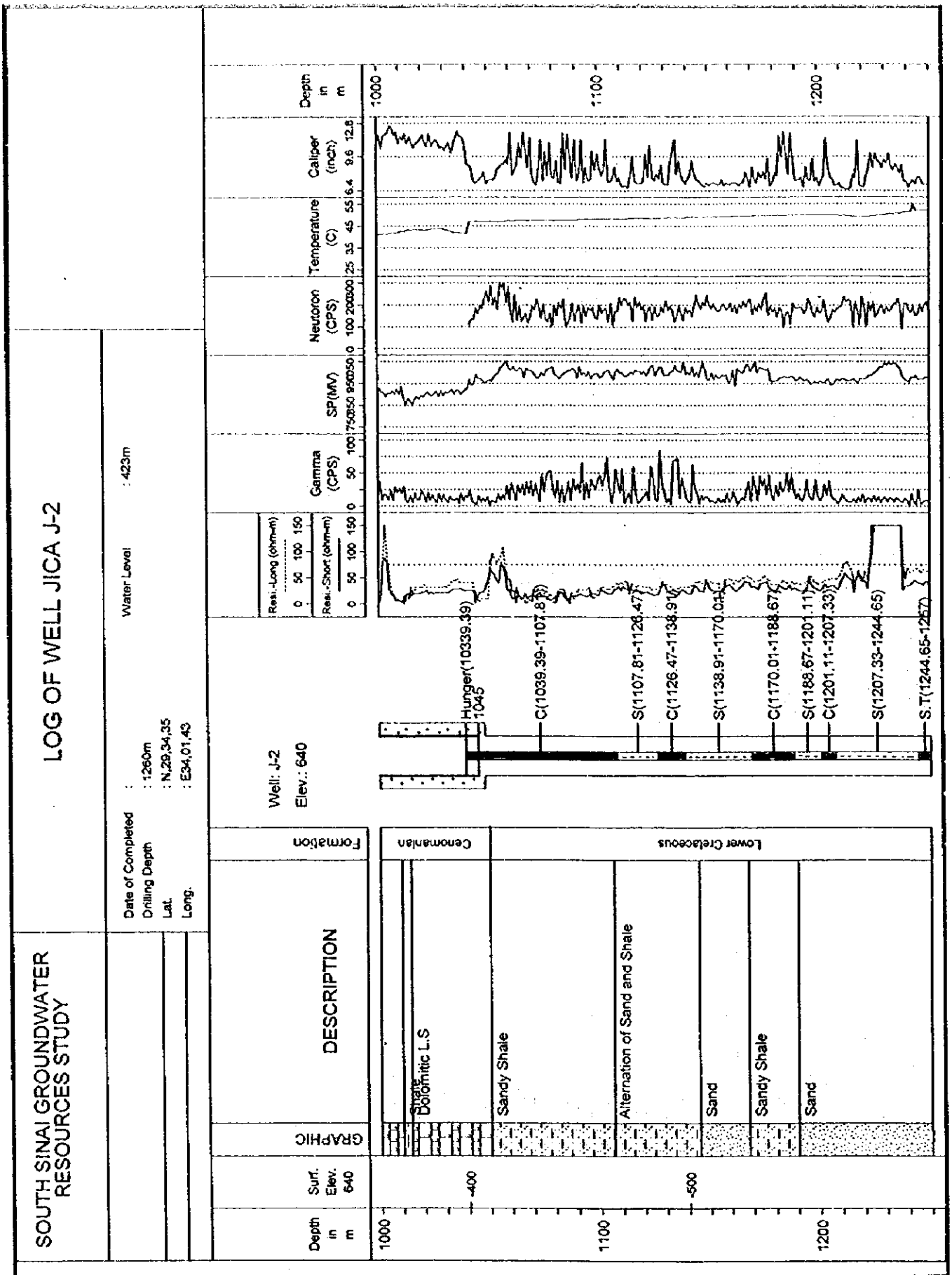


Fig. 7.3-2 Lithological Column (J-2) (Sheet 5 of 6)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

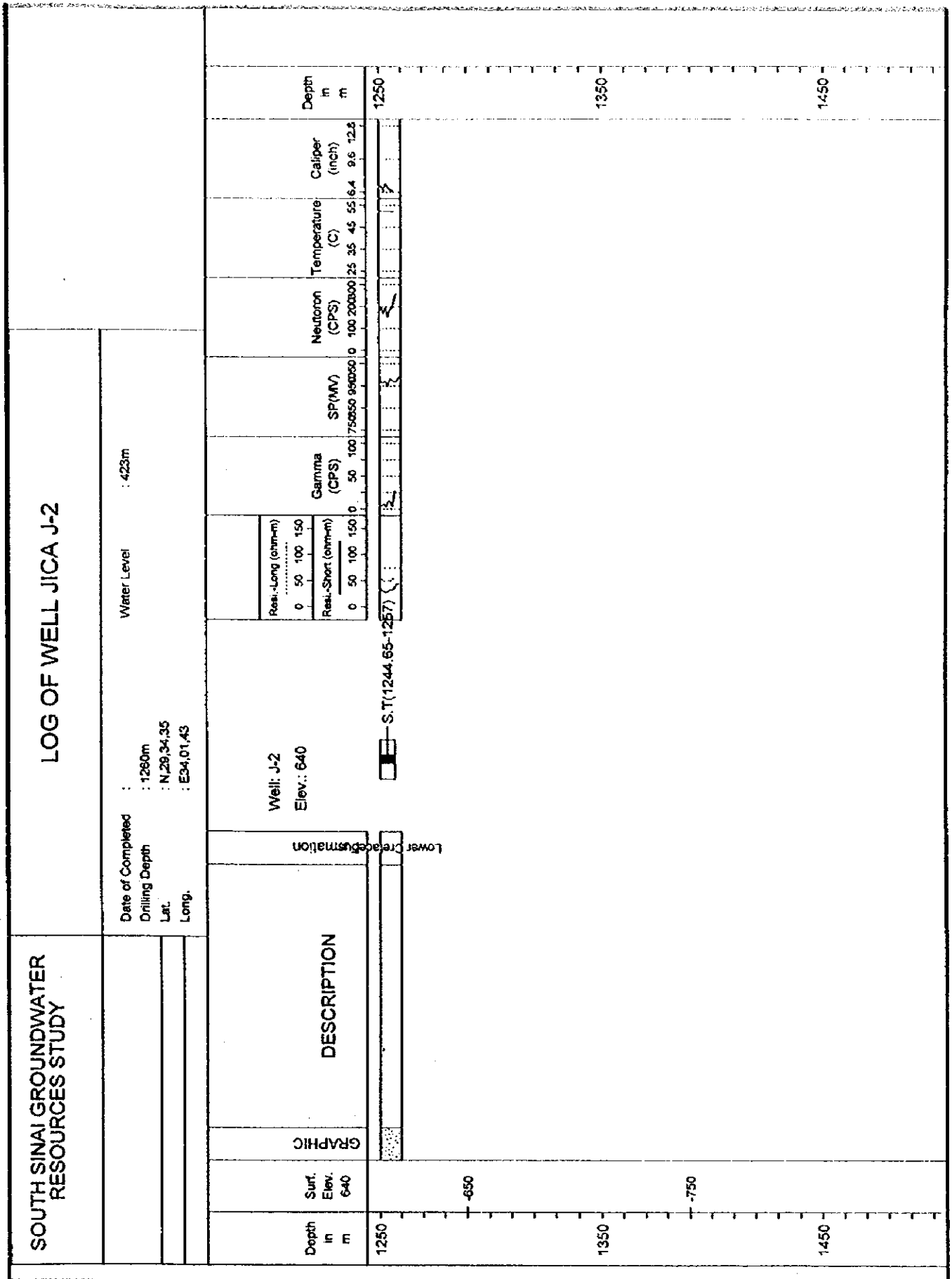


Fig. 7.3-2 Lithological Column (J-2) (Sheet 6 of 6)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

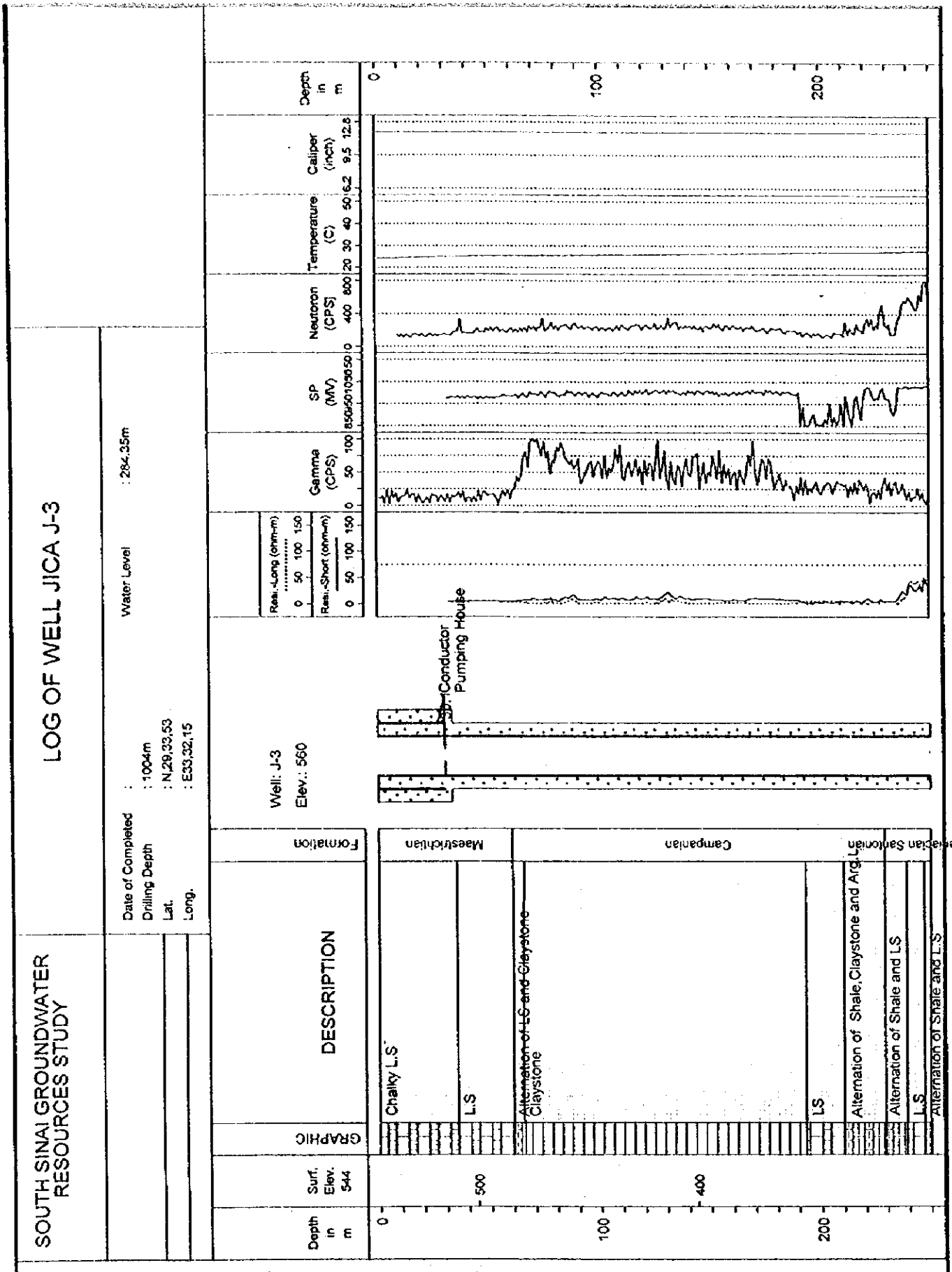


Fig. 7.3-3 Lithological Column (J-3) (Sheet 1 of 4)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

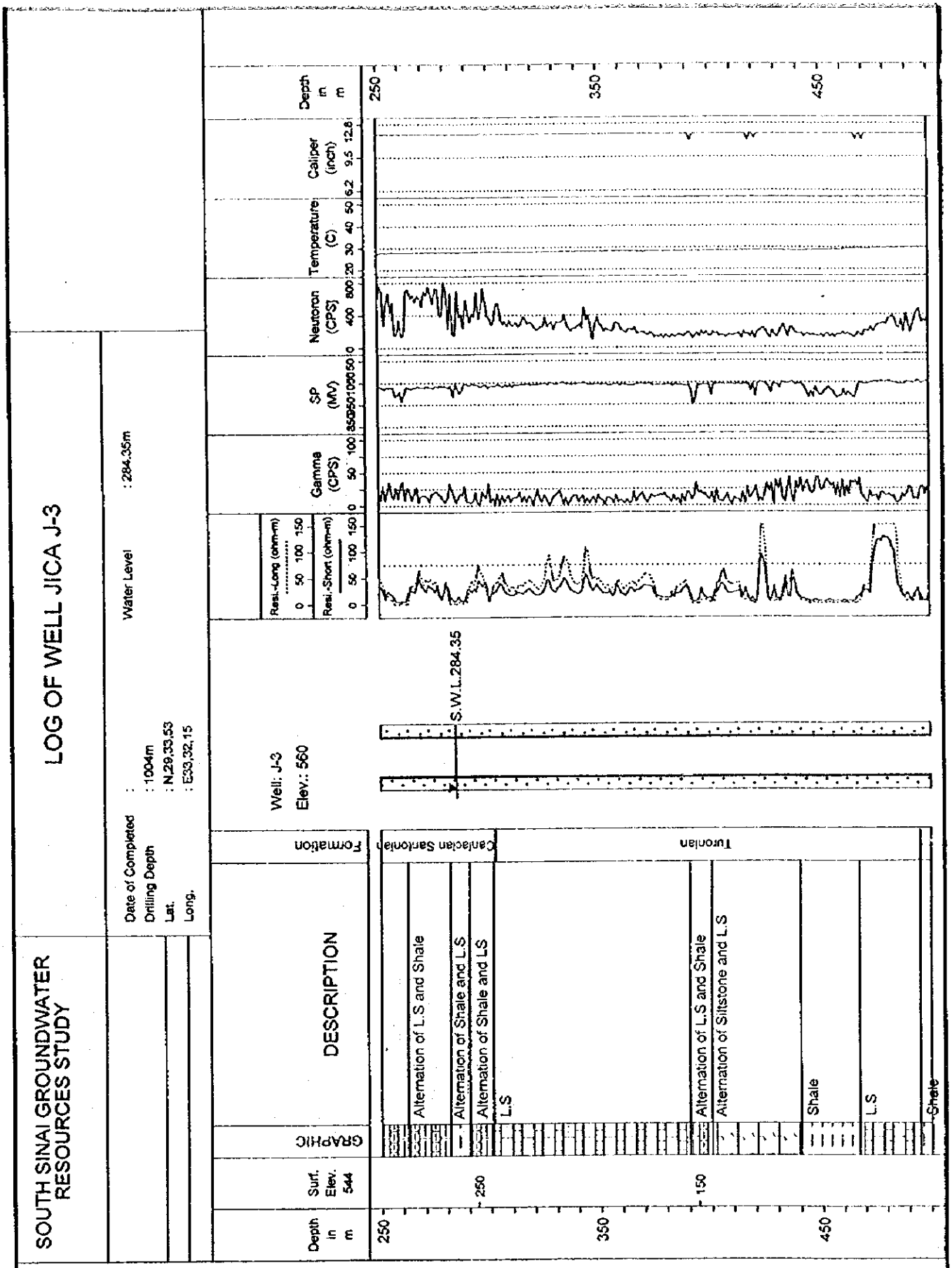


Fig. 7.3-3 Lithological Column (J-3) (Sheet 2 of 4)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

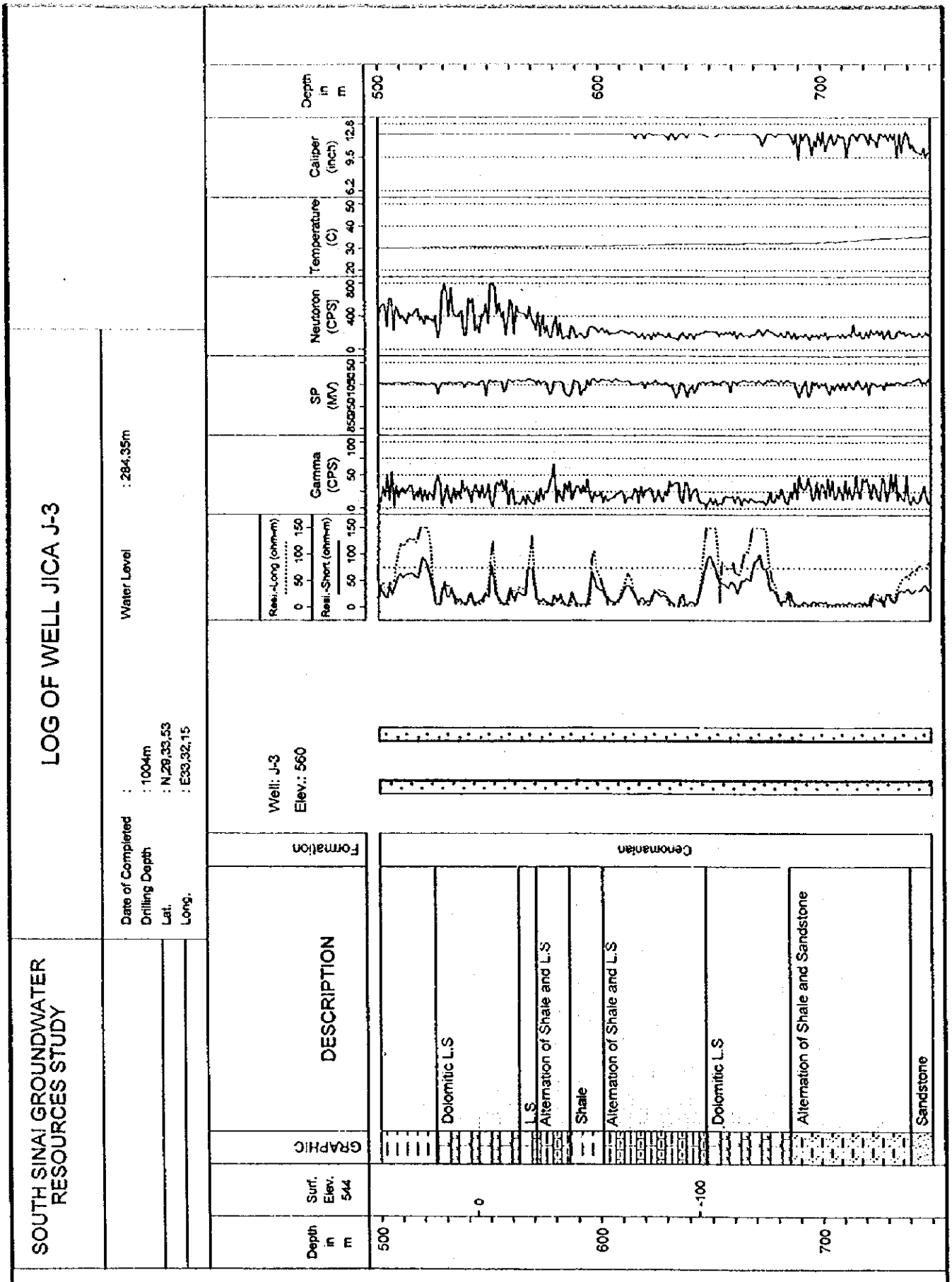


Fig. 7.3-3 Lithological Column (J-3) (Sheet 3 of 4)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

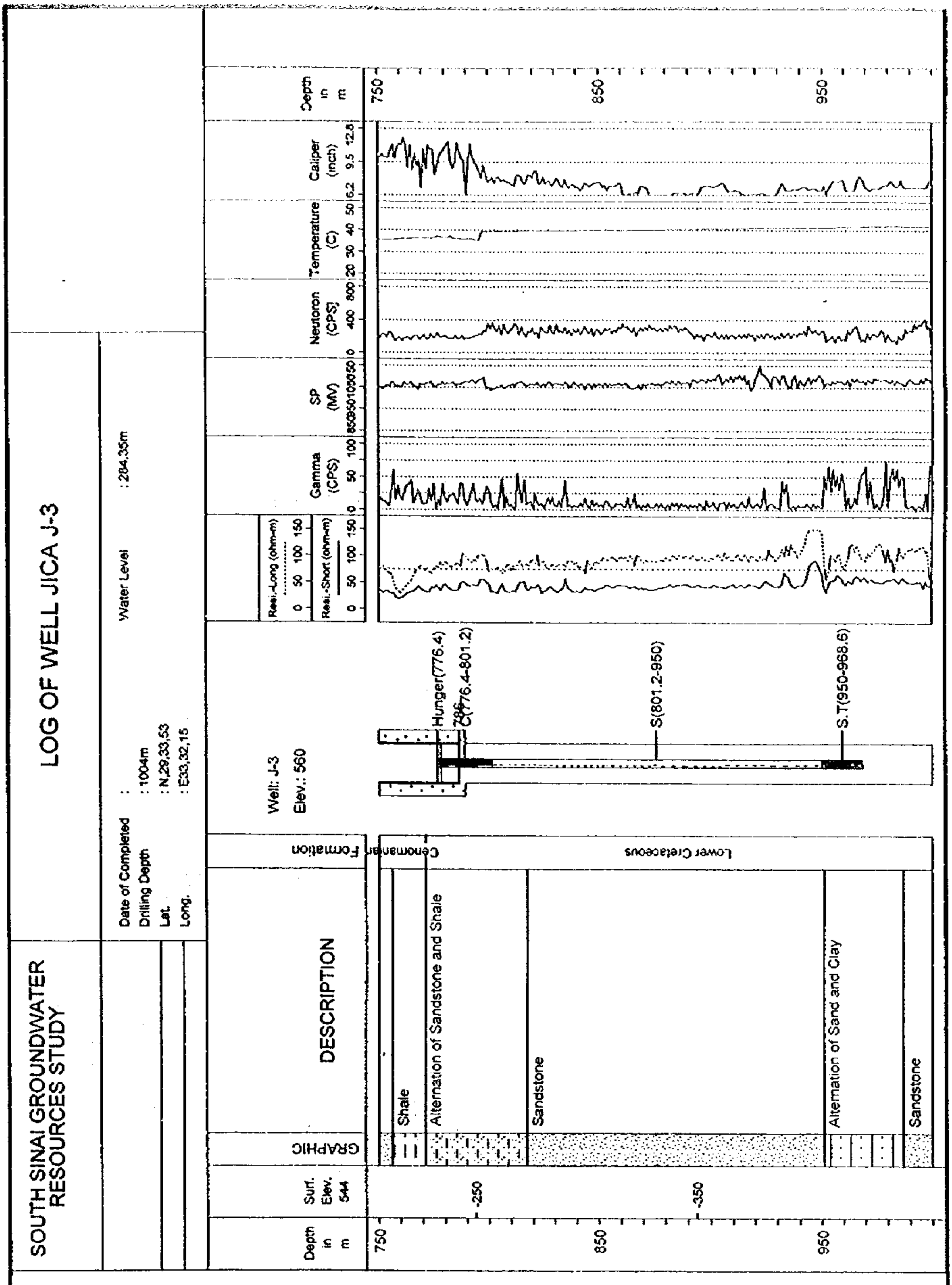


Fig. 7.3-3 Lithological Column (J-3) (Sheet 4 of 4)

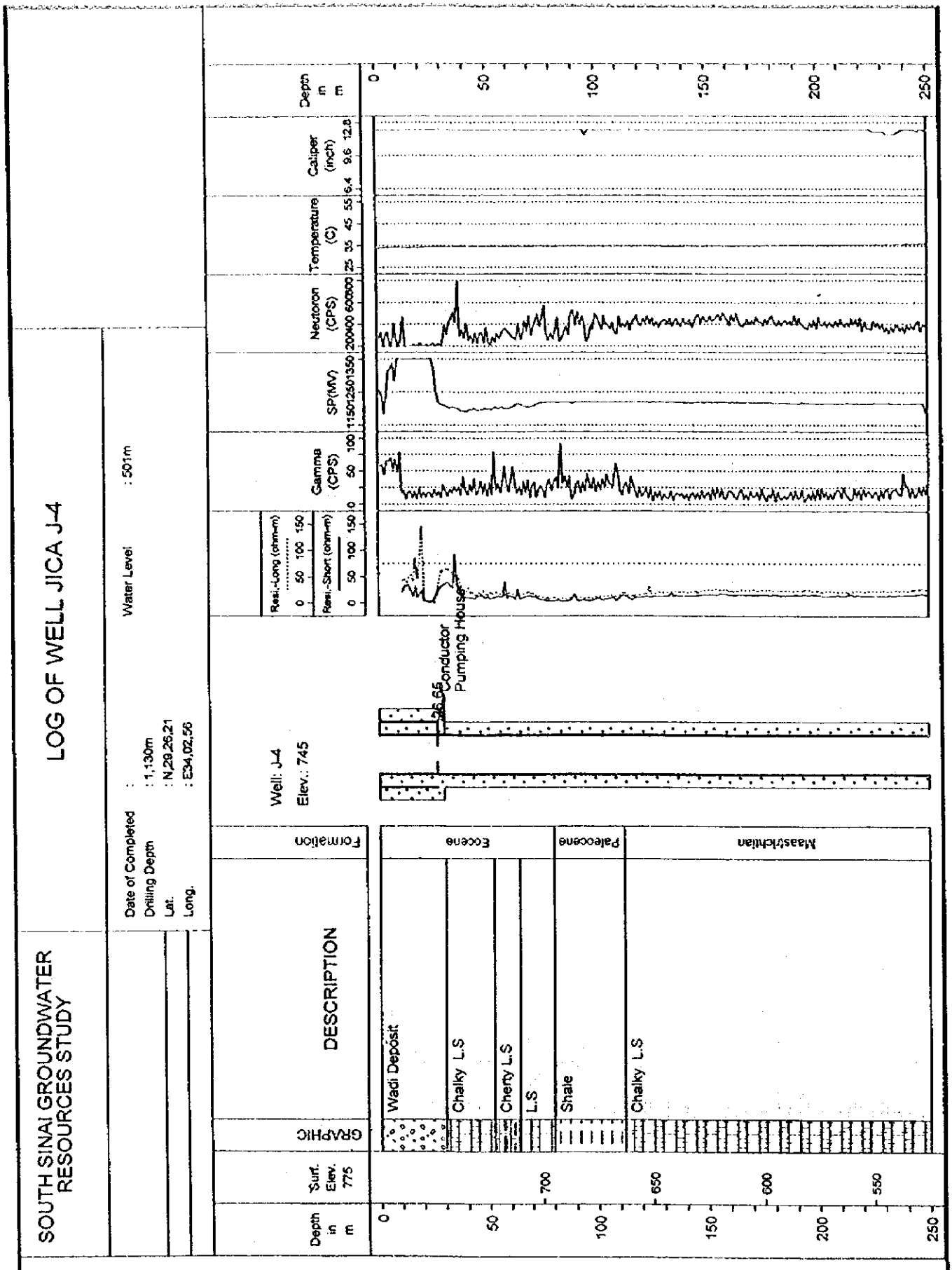


Fig. 7.3-4 Lithological Column (J-4) (Sheet 1 of 5)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

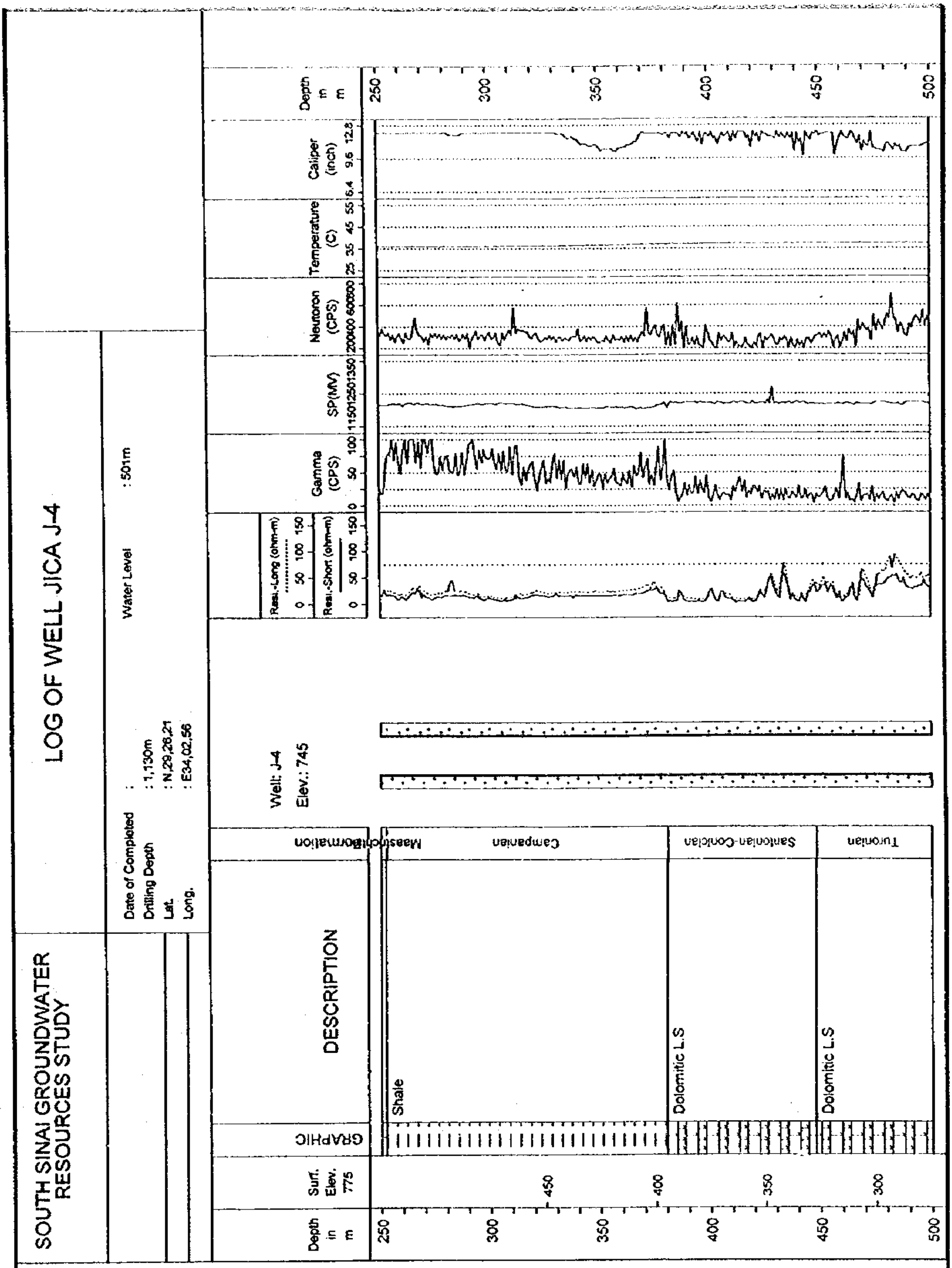


Fig. 7.3-4 Lithological Column (J-4) (Sheet 2 of 5)

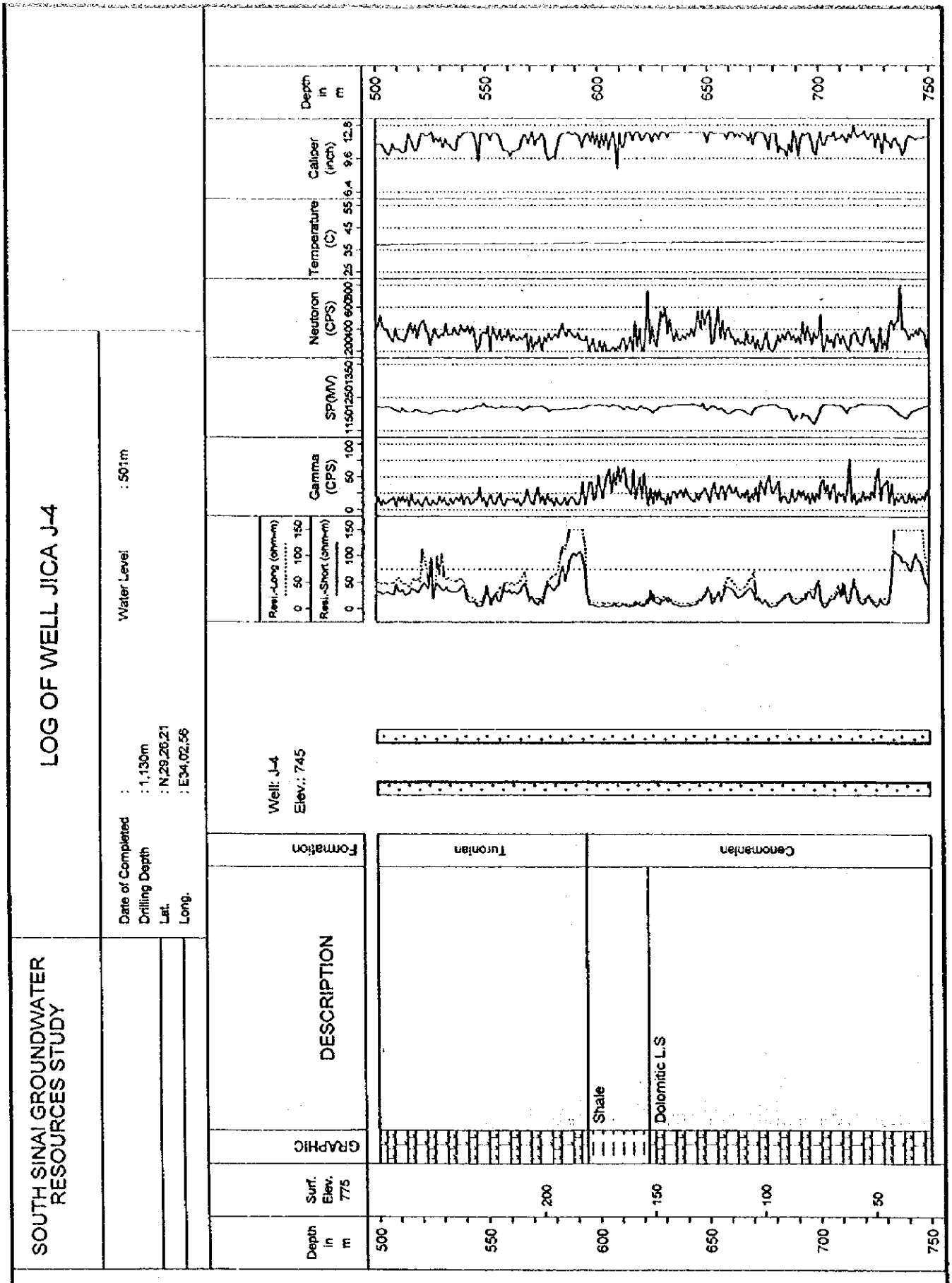


Fig. 7.3-4 Lithological Column (J-4) (Sheet 3 of 5)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

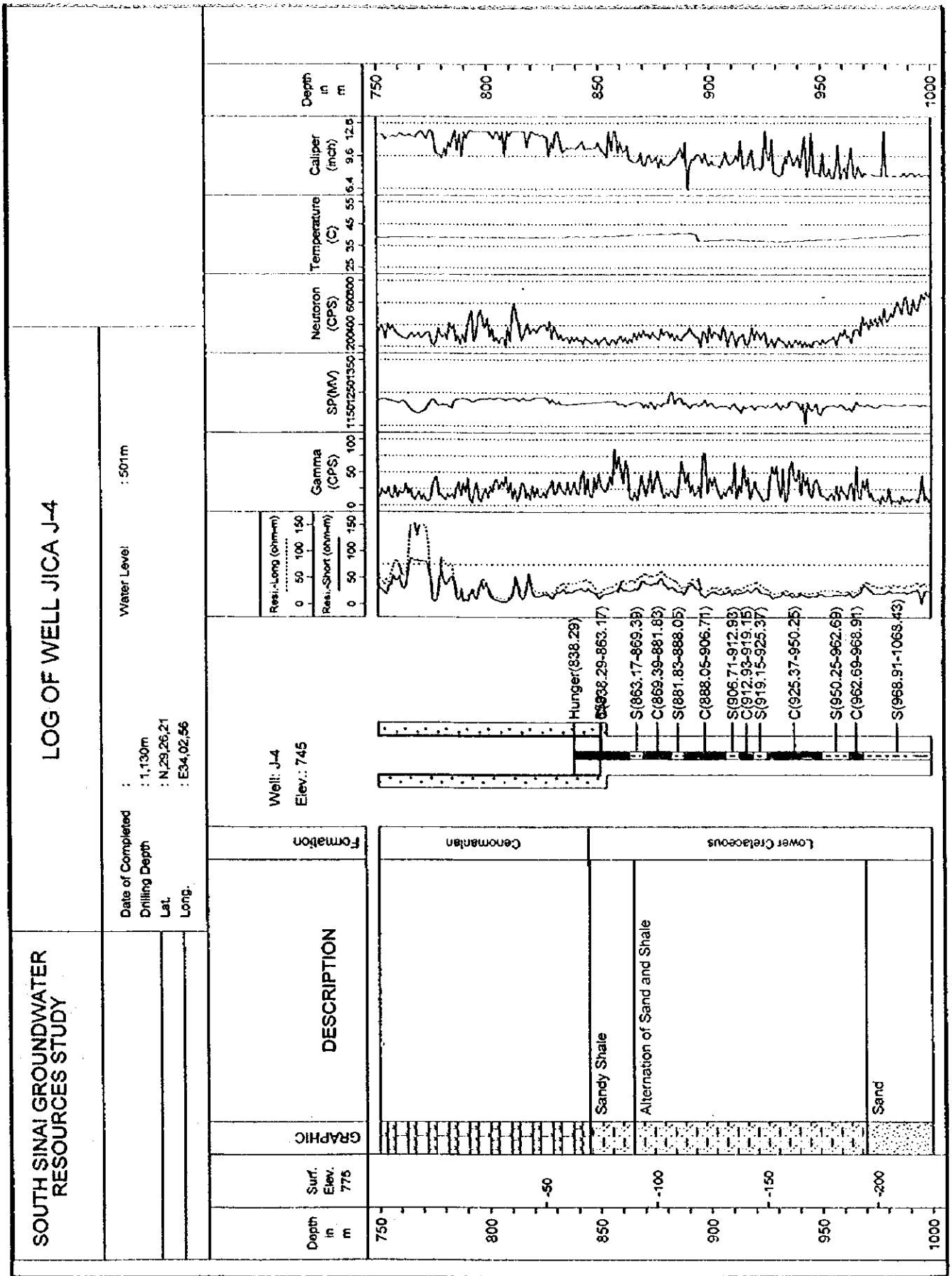


Fig. 7.3-4 Lithological Column (J-4) (Sheet 4 of 5)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

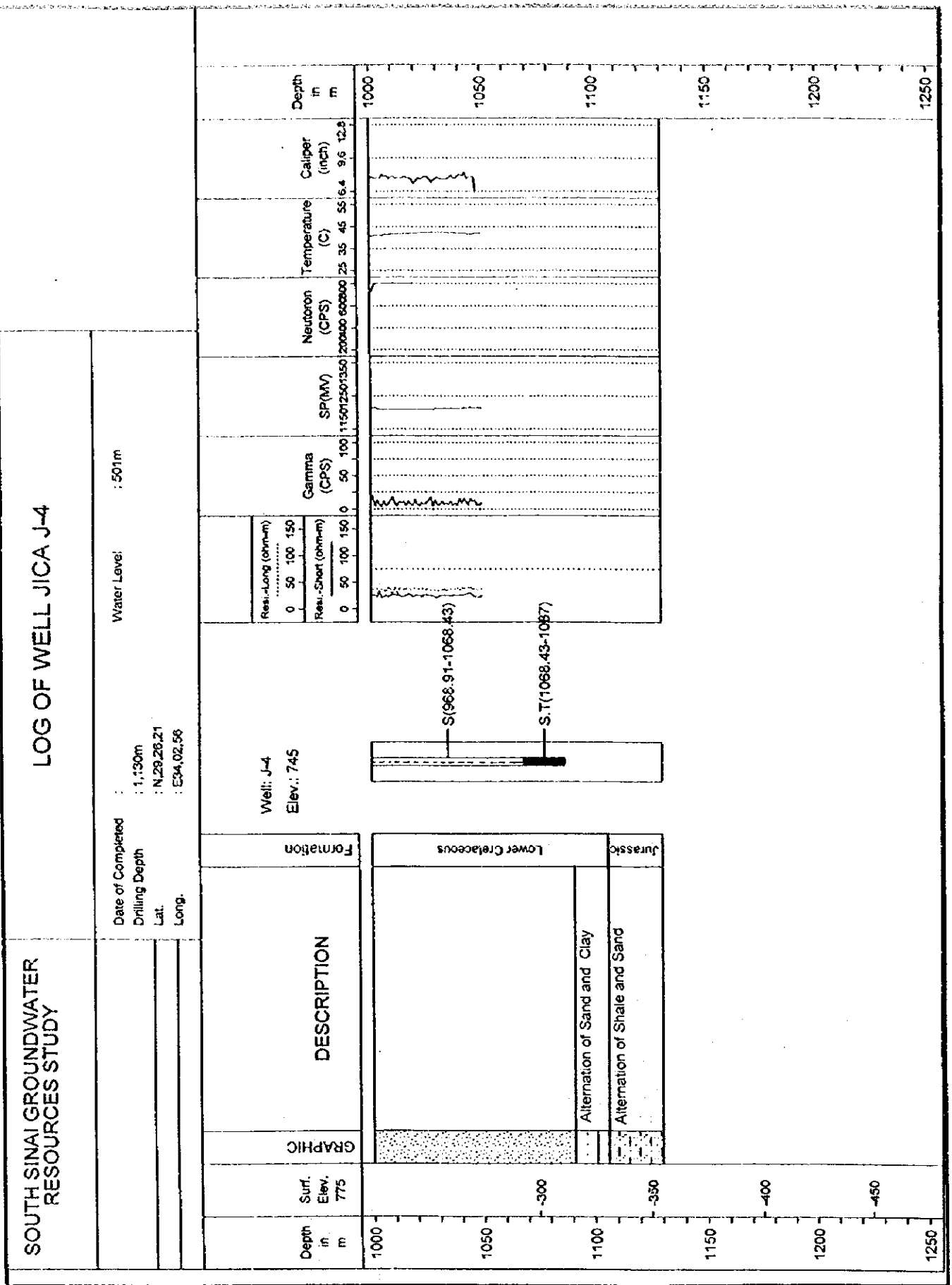


Fig. 7.3-4 Lithological Column (J-4) (Sheet 5 of 5)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

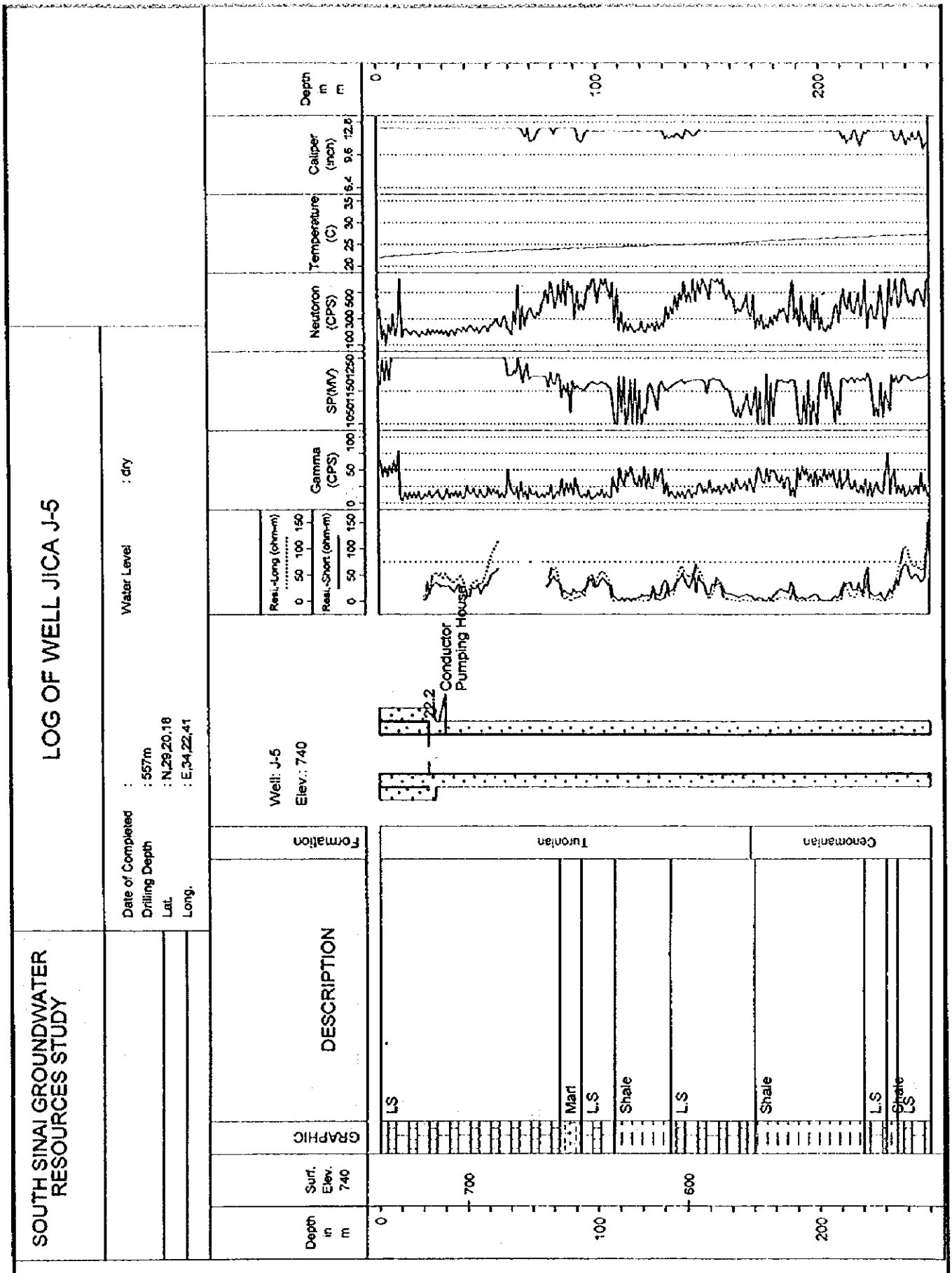


Fig. 7.3-5 Lithological Column (J-5) (Sheet 1 of 3)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

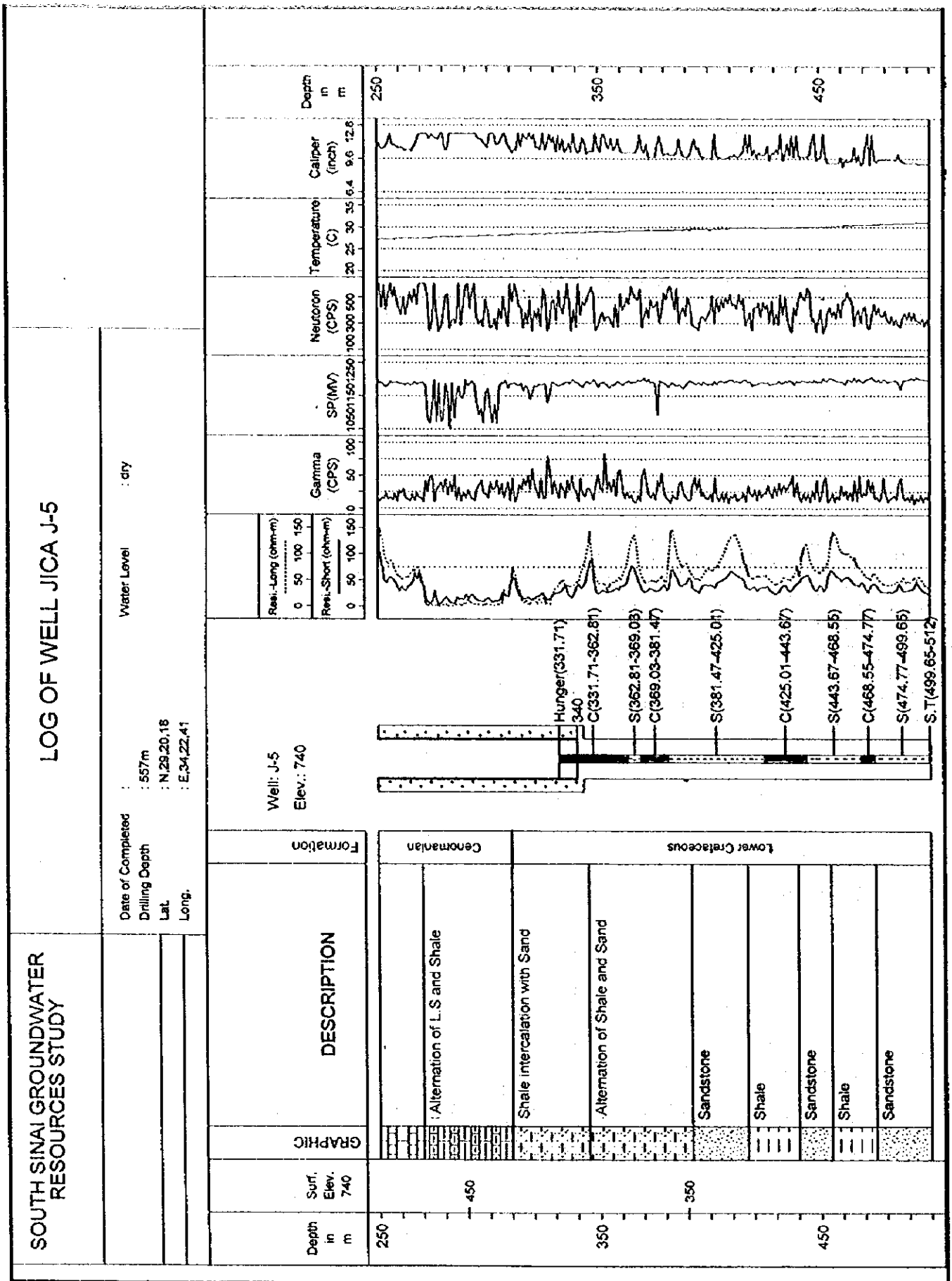


Fig. 7.3-5 Lithological Column (J-5) (Sheet 2 of 3)

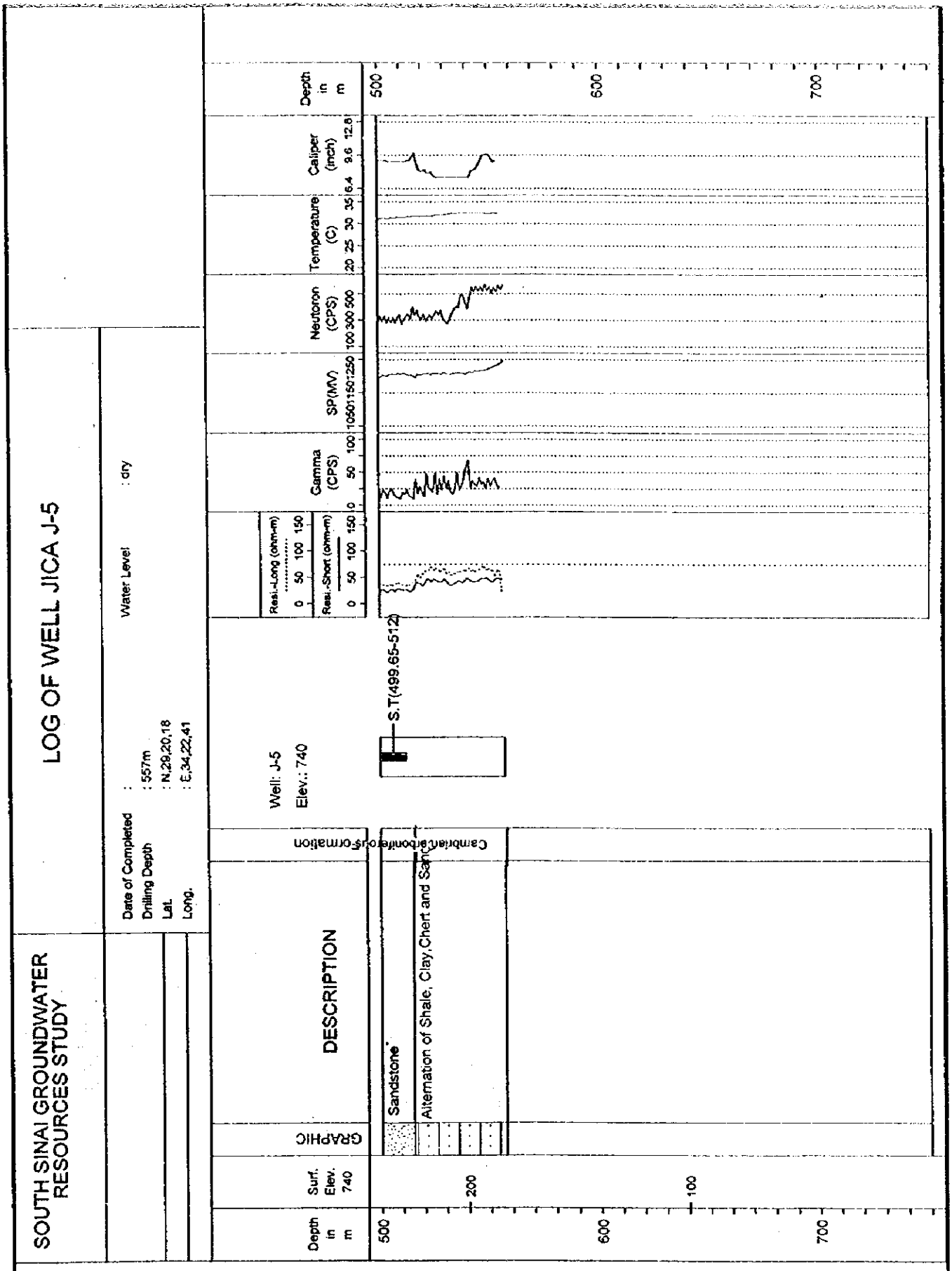


Fig. 7.3-5 Lithological Column (J-5) (Sheet 3 of 3)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

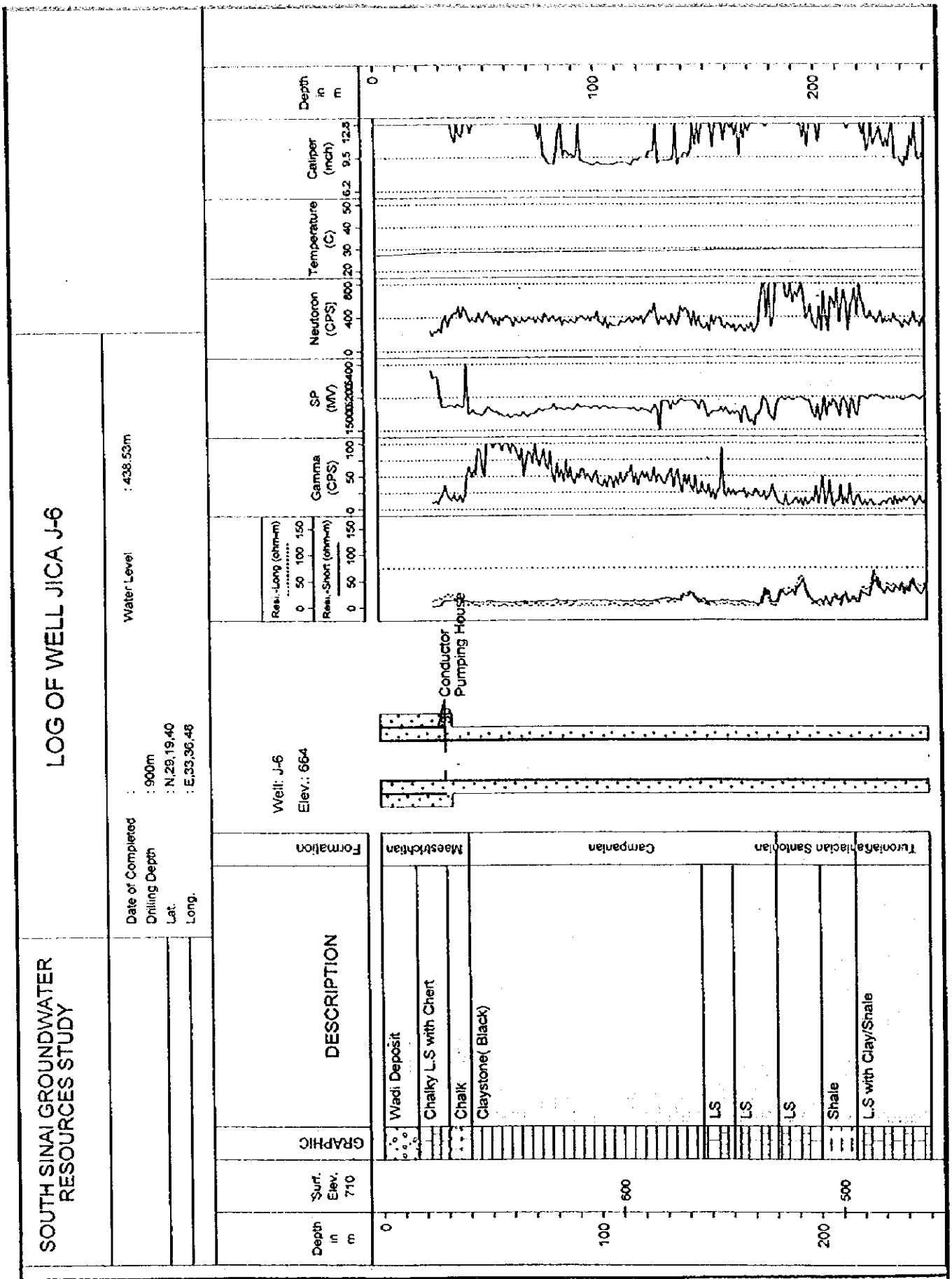


Fig. 7.3-6 Lithological Column (J-6) (Sheet 1 of 4)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

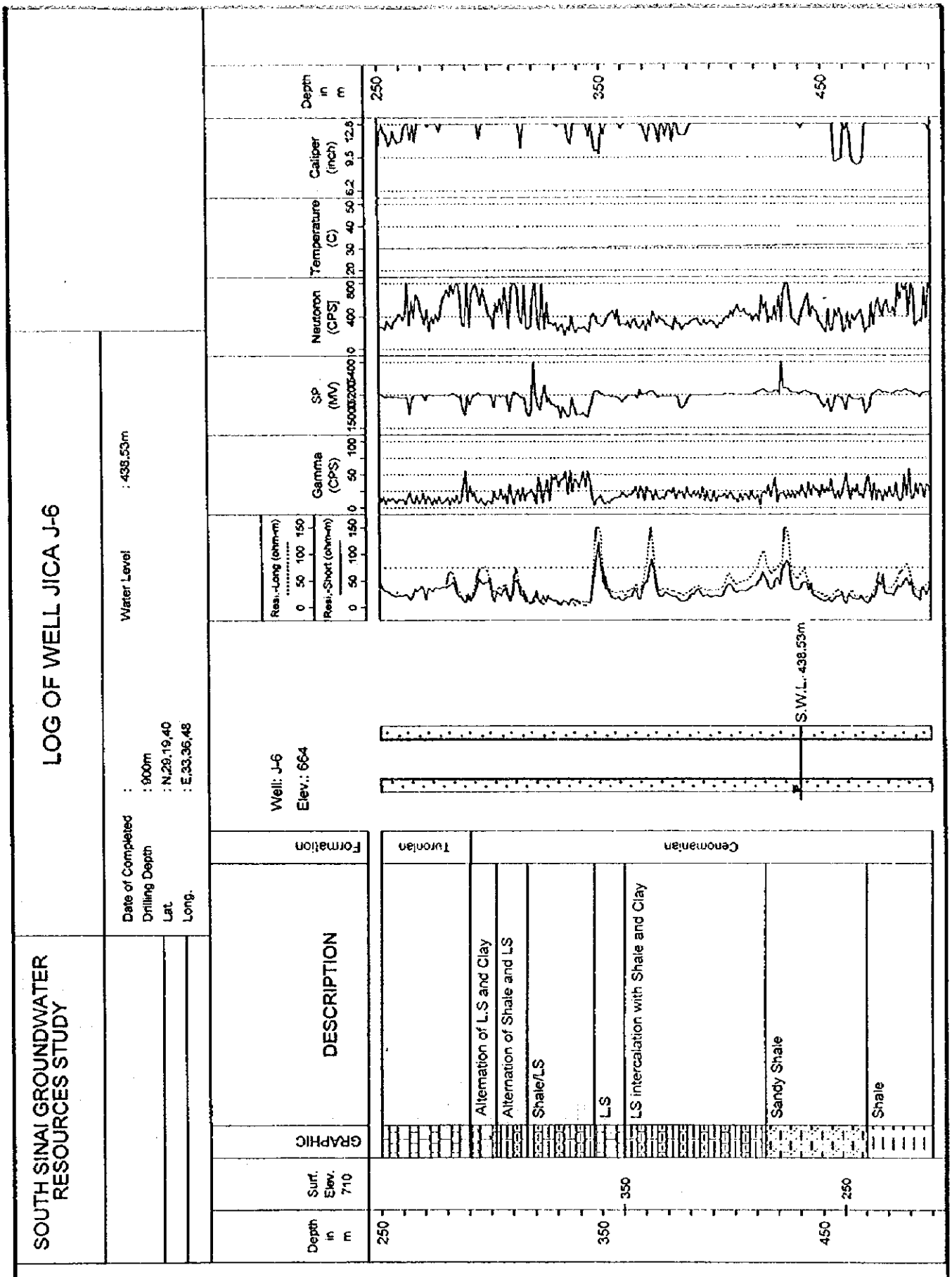


Fig. 7.3-6 Lithological Column (J-6) (Sheet 2 of 4)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

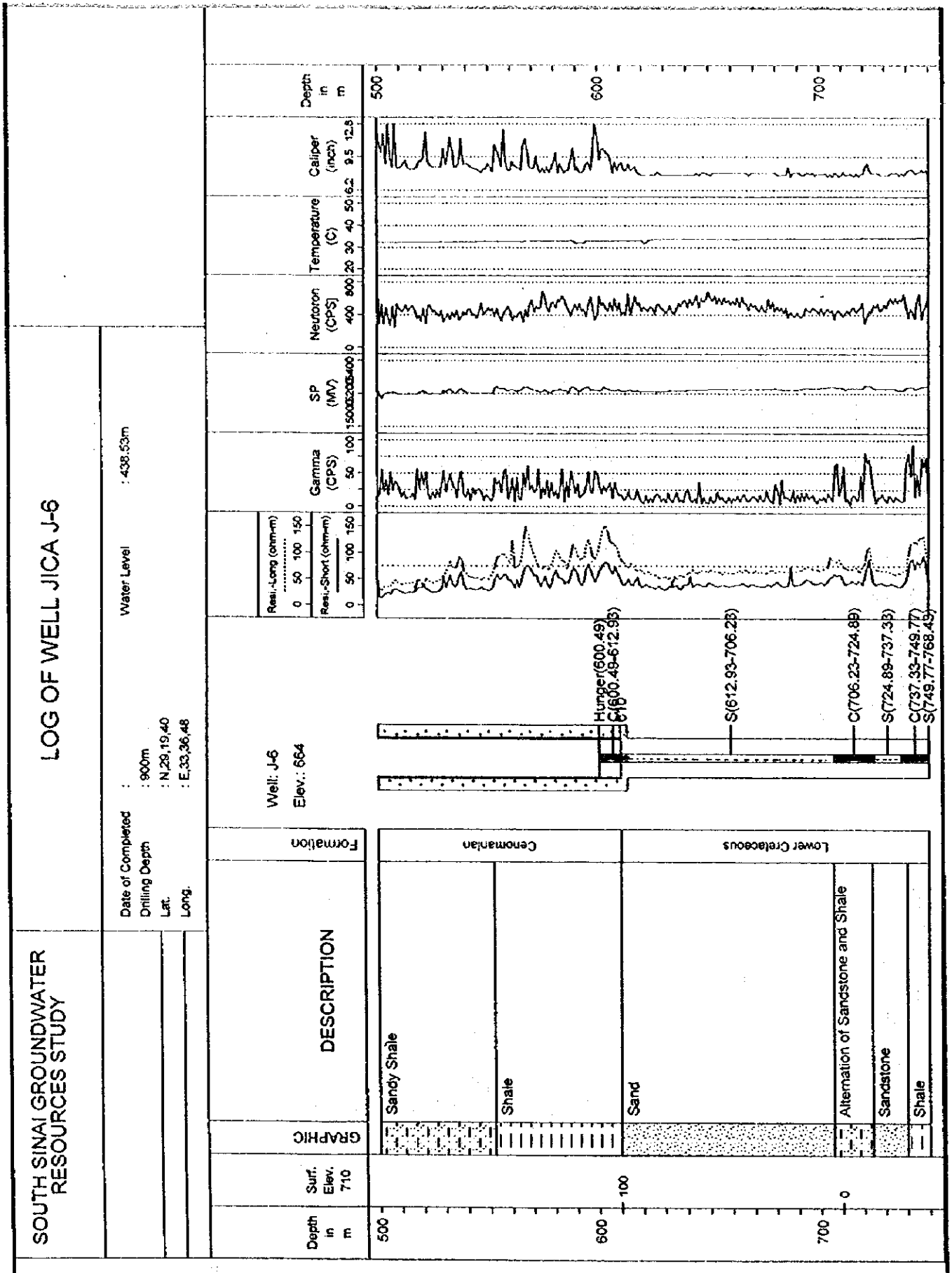


Fig. 7.3-6 Lithological Column (J-6) (Sheet 3 of 4)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

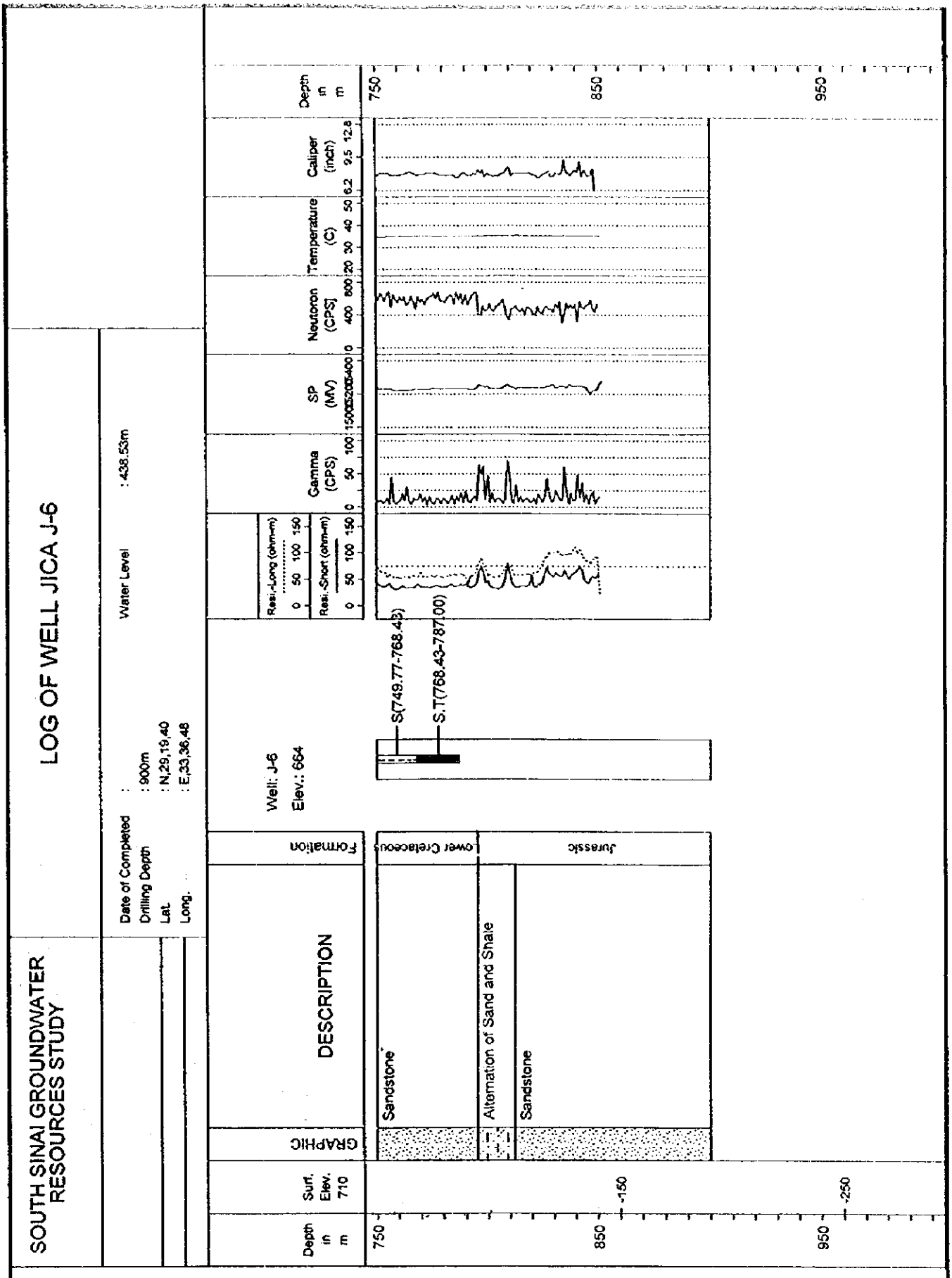


Fig. 7.3-6 Lithological Column (J-6) (Sheet 4 of 4)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

SOUTH SINAI GROUNDWATER RESOURCES STUDY

LOG OF WELL JICA J-7

(Page 1 of 1)

Date of Completed :
Drilling Depth : 250m
Lat. : N28,08.29
Long. : E35,52,18
Water Level : 142.77 m

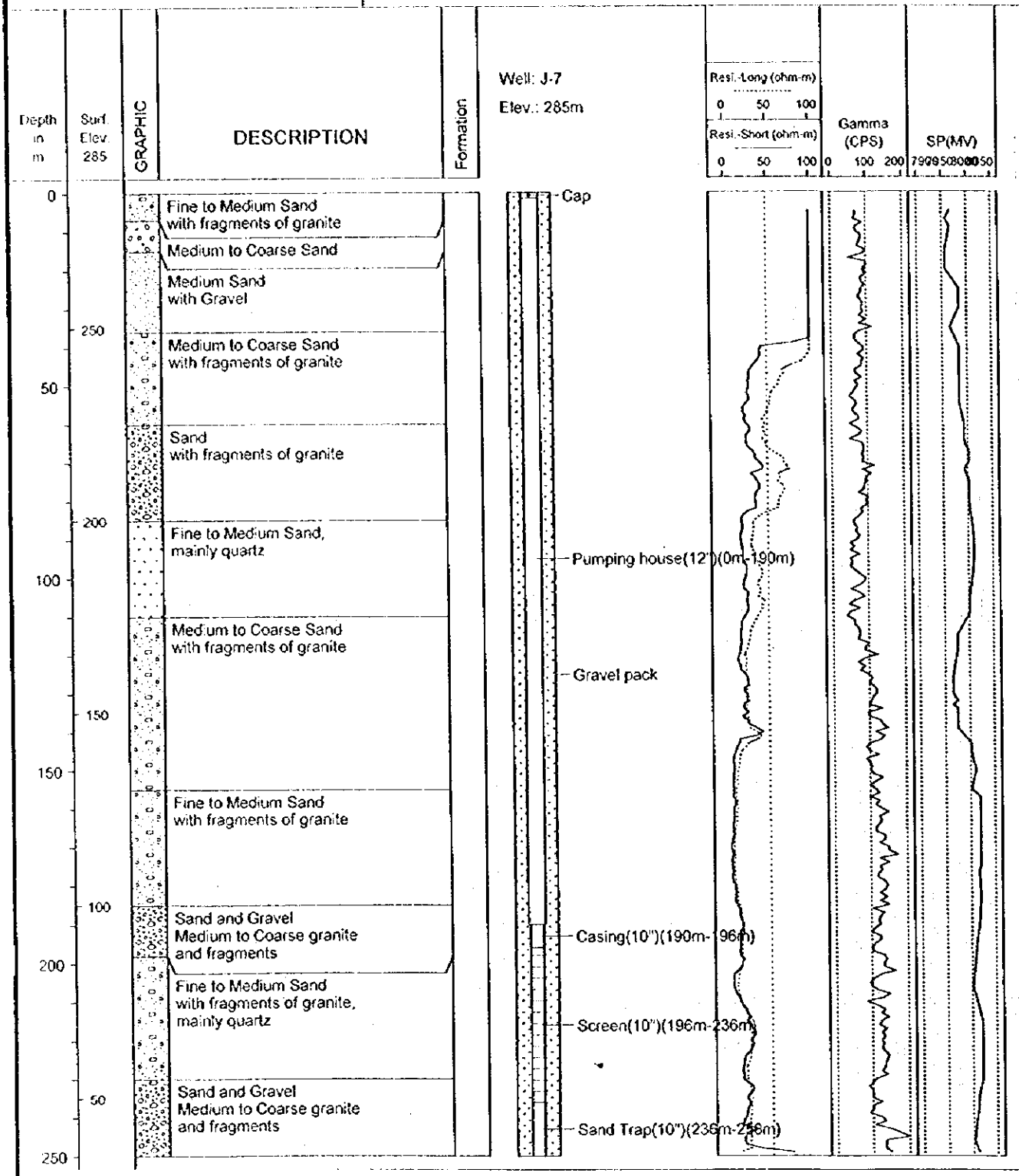


Fig. 7.3-7 Lithological Column (J-7)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA

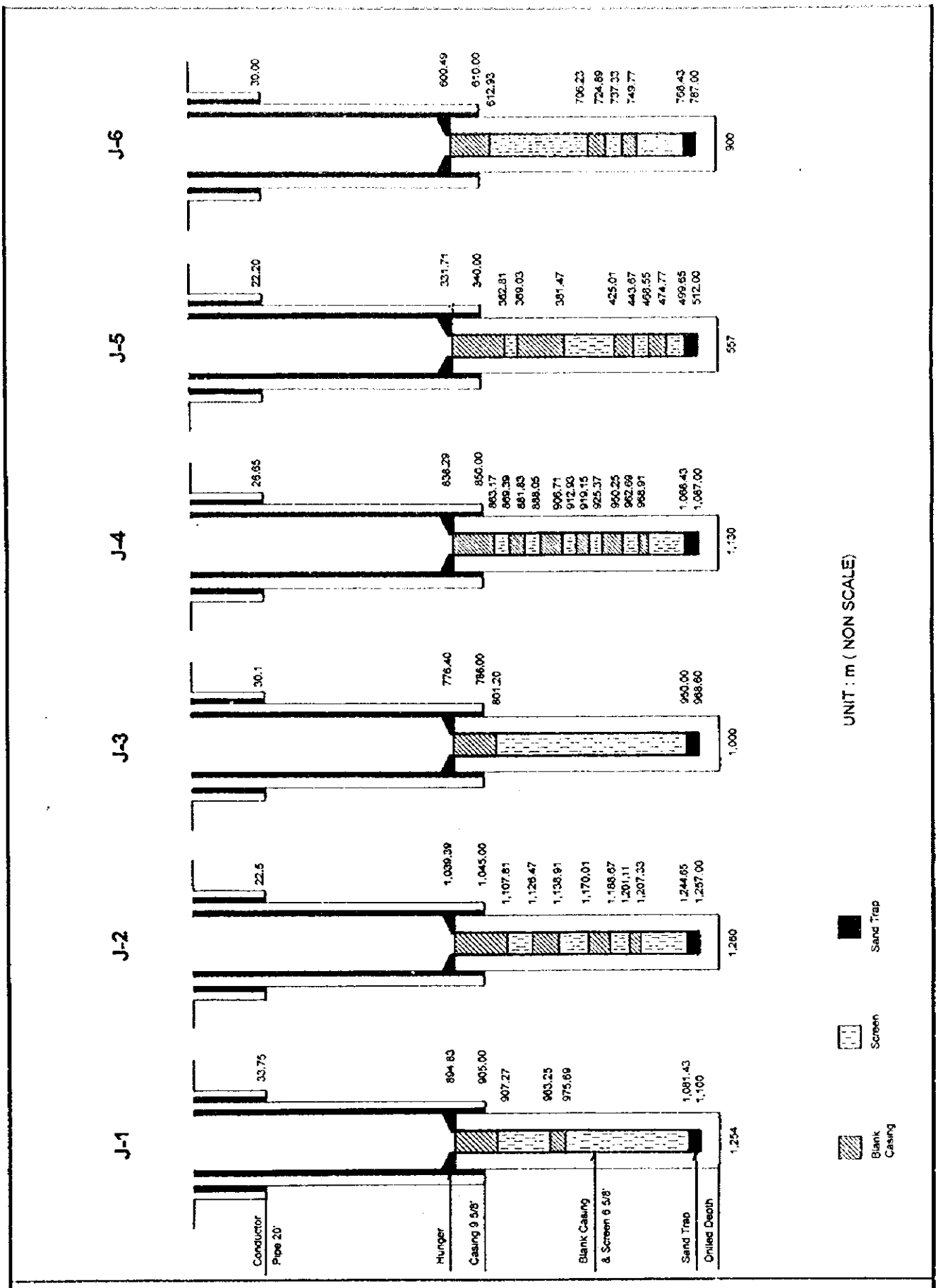
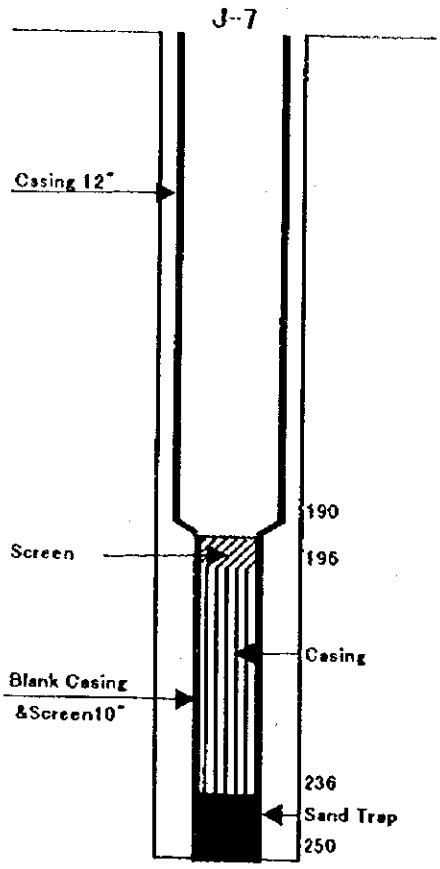


Fig. 7.3-8 Casing Design J-1~6

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA



Unit:m (NON SCALE)

Fig. 7.3-8 Casing Design J-7

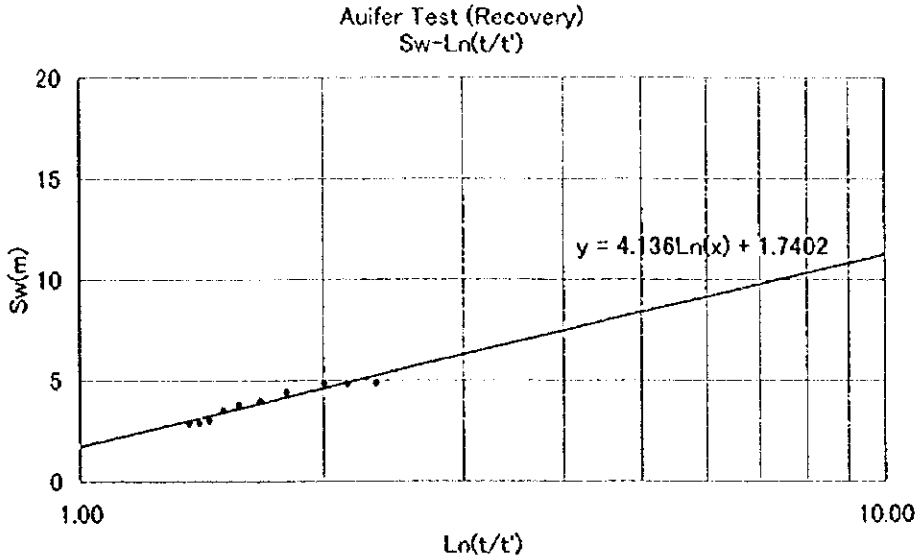
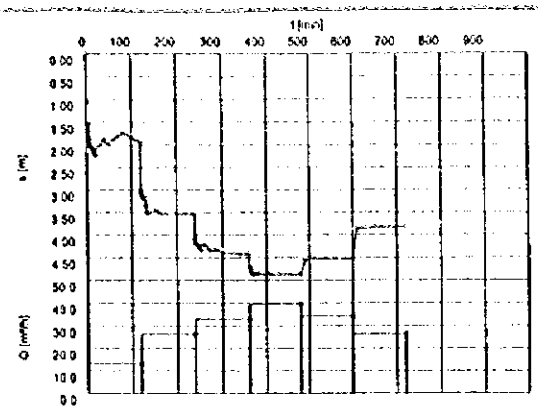
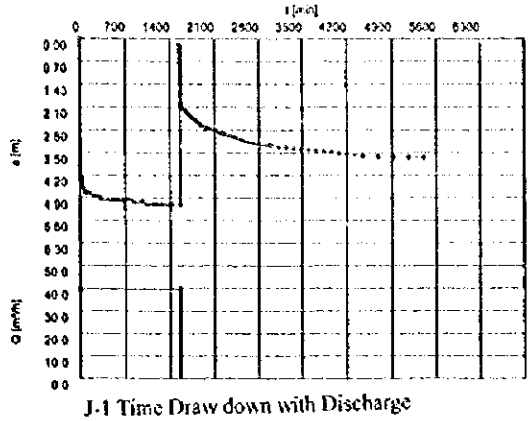


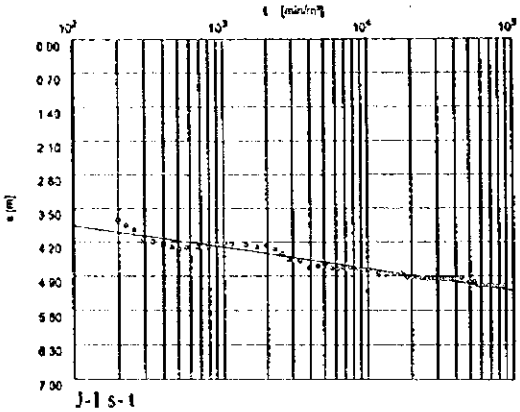
Fig. 7.3.1-1 Graph for Aquifer Test (J-1)



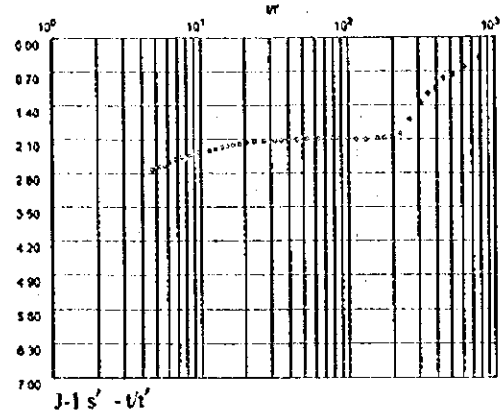
J-1 Time Draw down with Discharge



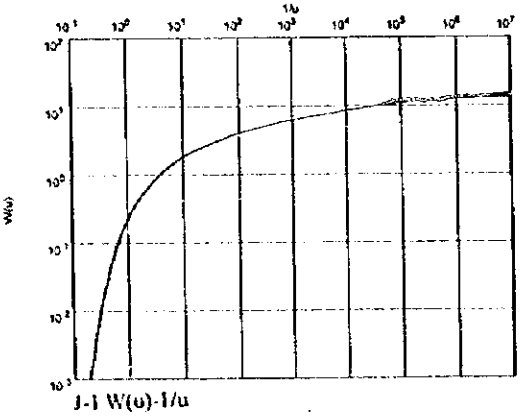
J-1 Time Draw down with Discharge



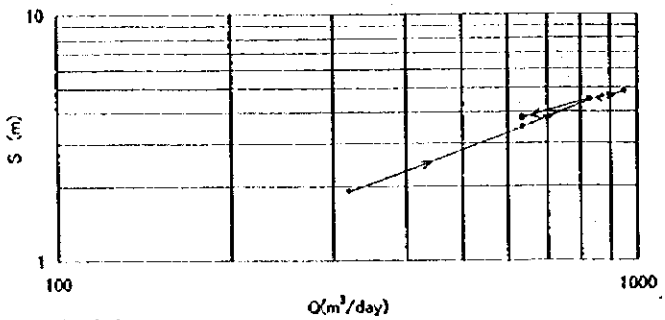
J-1 s-t



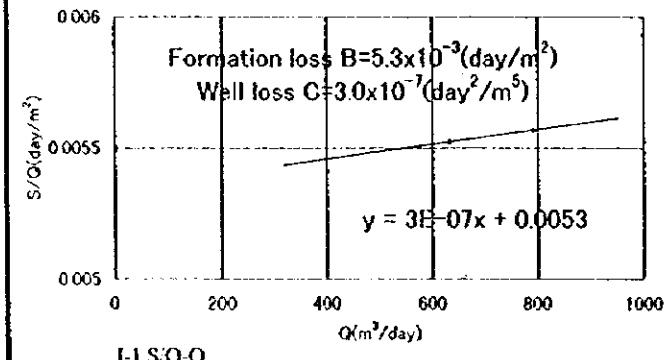
J-1 s' -t/t'



J-1 W(u)-1/u

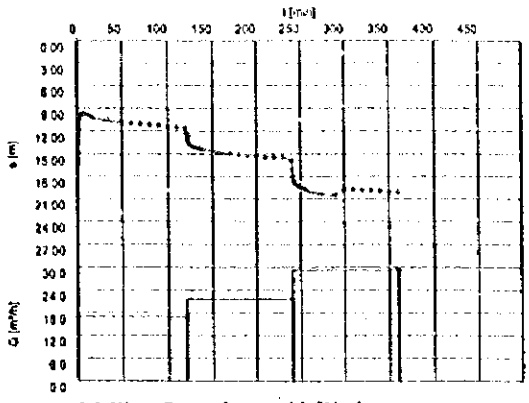


J-1 S-Q

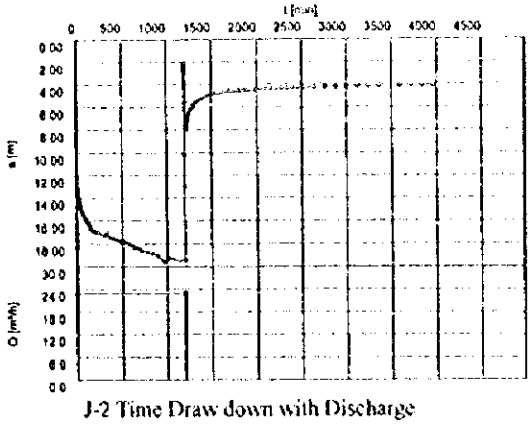


J-1 S/Q-Q

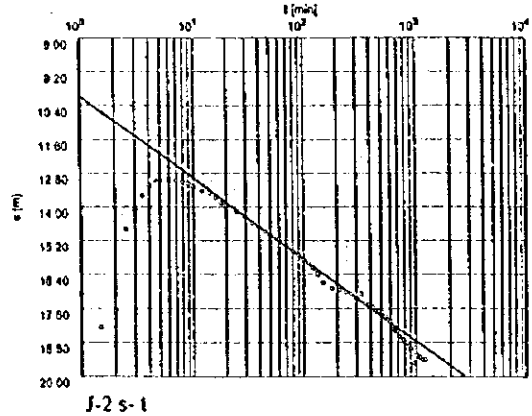
Fig. 7.3.1-2 Graphs for Pumping Test (J-1)



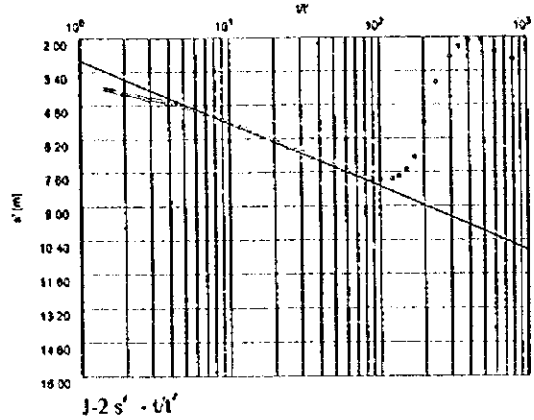
J-2 Time Draw down with Discharge



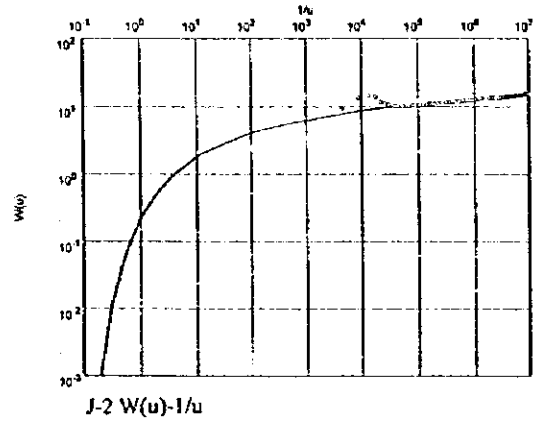
J-2 Time Draw down with Discharge



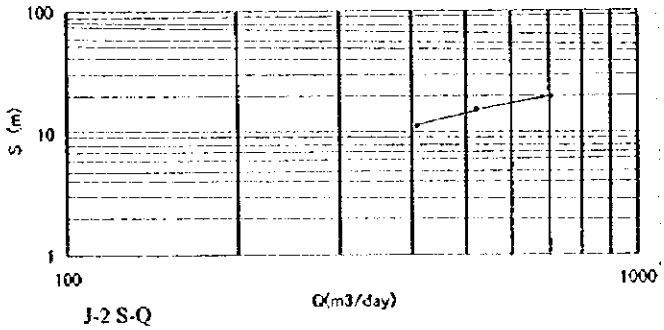
J-2 s- t



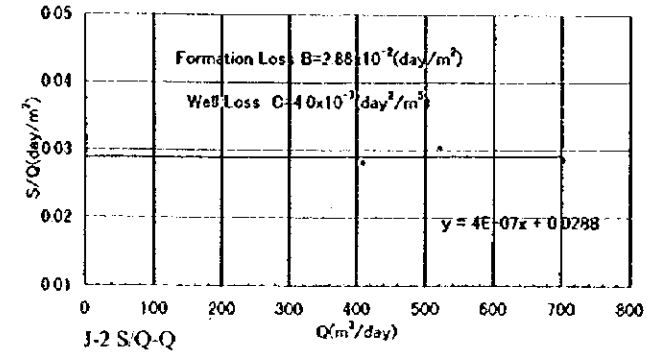
J-2 s' - t/t'



J-2 W(u)-1/u

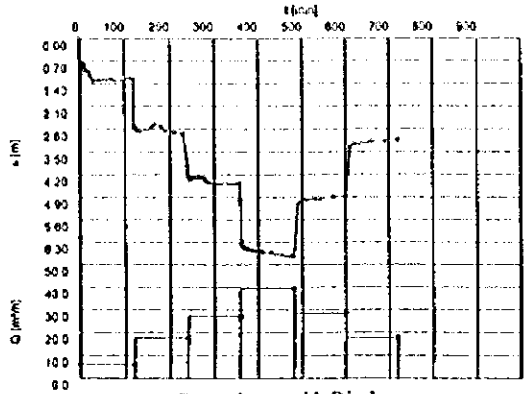


J-2 S-Q

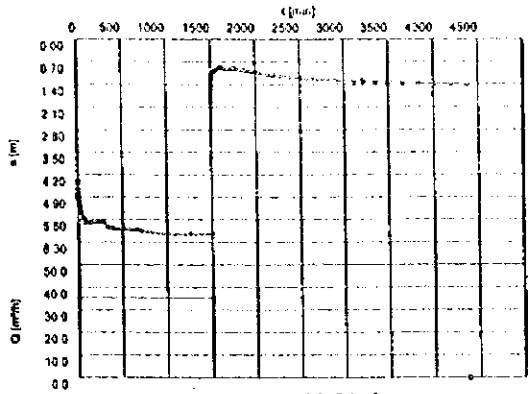


J-2 S/Q-Q

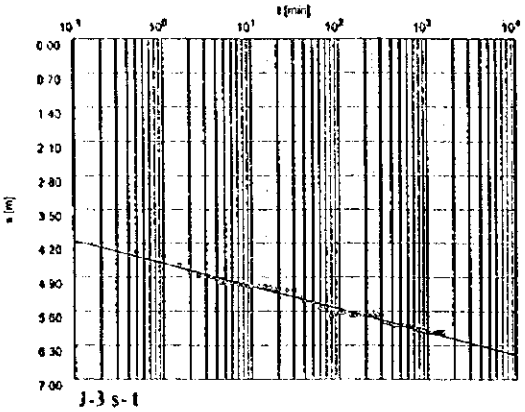
Fig. 7.3.2 -1 Graphs for Pumping Test (J-2)



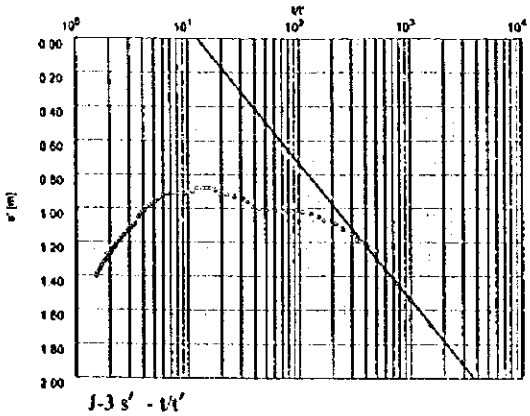
J-3 Time Draw down with Discharge



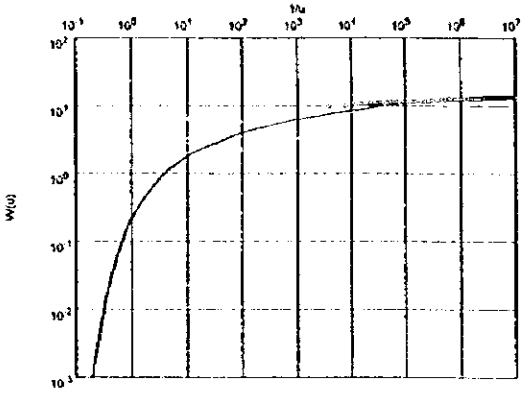
J-3 Time Draw down with Discharge



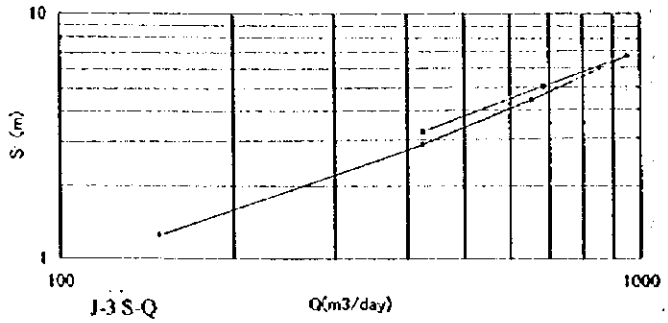
J-3 s-t



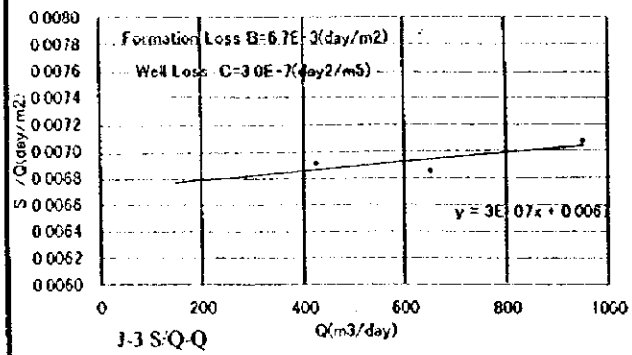
J-3 s' - t/t'



J-3 W(u)-1/u

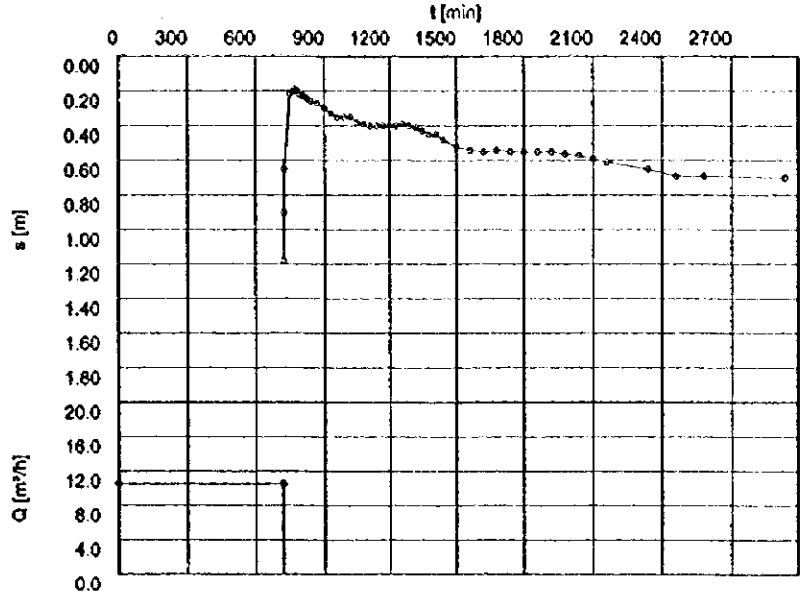


J-3 S-Q

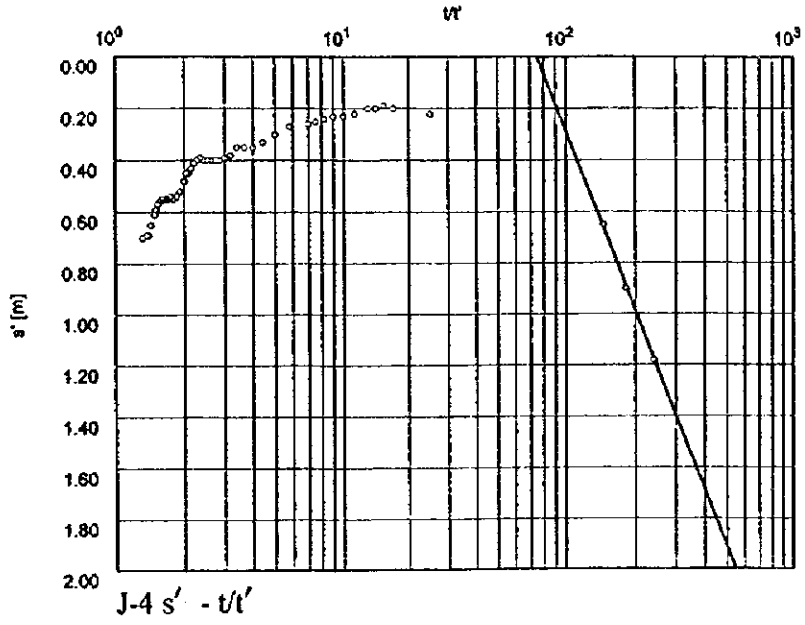


J-3 S/Q-Q

Fig. 7.3.3 -1 Graphs for Pumping Test (J-3)



J-4 Time Draw down with Discharge



J-4 s′ - t/t′

Fig. 7.3.4 -1 Graphs for Pumping Test (J-4)

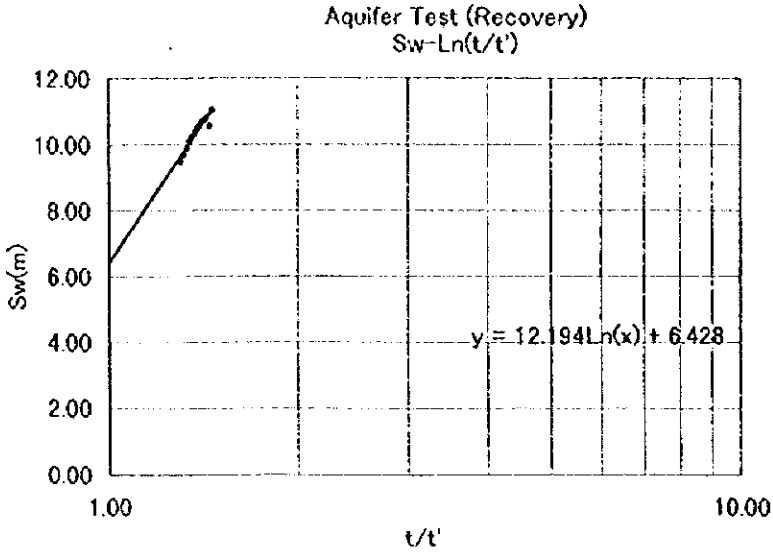
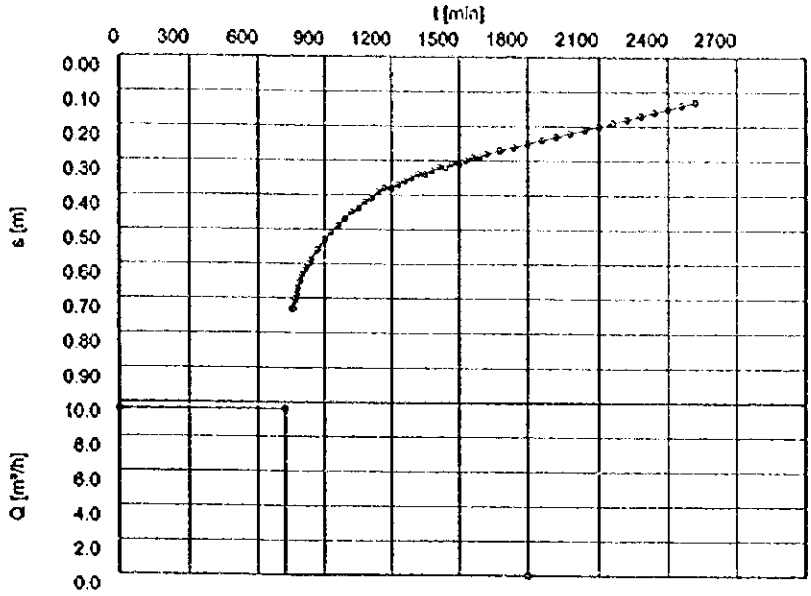
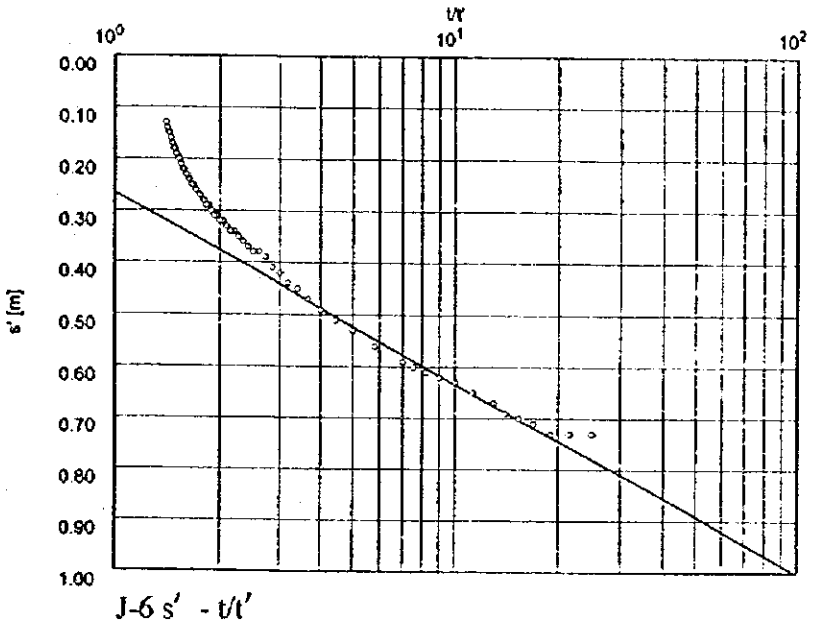


Fig 7.3.6 -1 Graph for Aquifer Test (J-6)

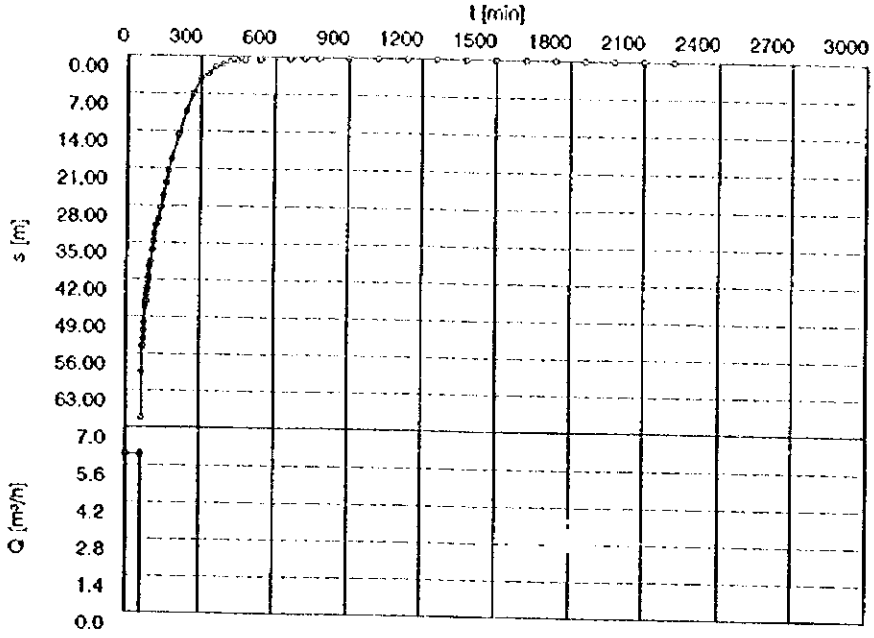


J-6 Time Draw down with Discharge

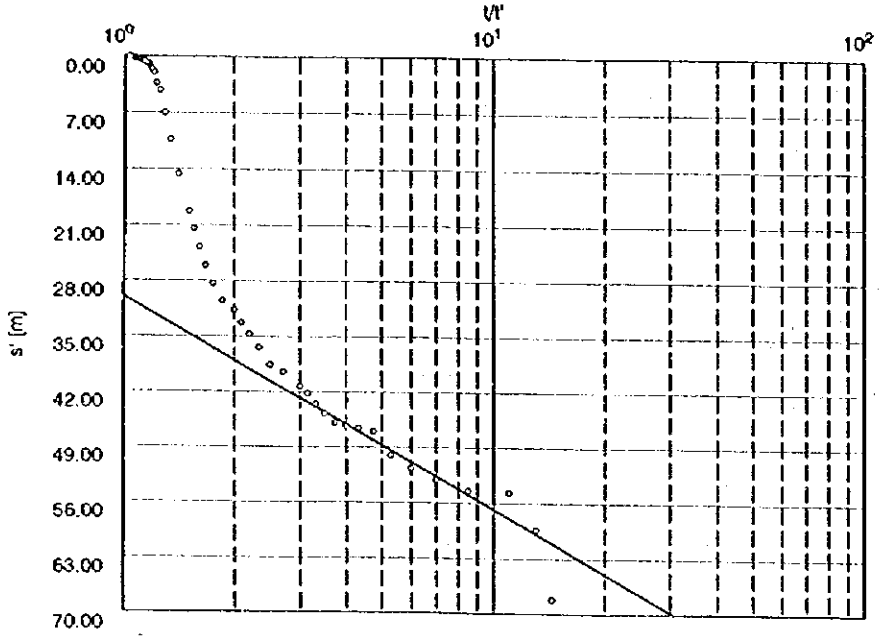


J-6 s' - t/t'

Fig. 7.3.6-2 Graphs for Pumping Test (J-6)



J-7 Time Drawdown with Discharge



J-7 S'-t/t'

Fig. 7.3.7-1 Graphs for Pumping Test (J-7)