Geological characteristics and provisions at the proposed dam axis consist of the following items.

a) Stratum which comprises the dam site vicinity is Okhalhadunga Phyllite.

b) Foundation rock at the dam axis consists of phyllite-quartzite conglomerate in the lowest layer of the Okhaldhunga stratum.

c) Strike and dip of the stratum at the dam axis is ENE-WSW/40 - 60°.

d) The Dudh Kosi Fault extends along the strike-trend of the stratum in the riverbed.

(1) Considerations

The main difficulty at this site is the existence of the Dudh Kosi Fault and a detailed check of shear zone scale, etc., is therefore necessary. The stratigraphy is quite complex with alternate layers of phyllite quartzite and conglomerate. As the strike-dip is ENE-WSW and 40 - 60°N, the left bank slope will be susceptible to sliding during excavation.

In view of the above items, selection of the dam axis between the Dudh Kosi Fault and the Dudh Kosi River, which runs parallel to the same, is undesirable.

2.4 Field Investigation for Irrigation Diversion Plan

Irrigation water for irrigation development in the Terai Zone will be supplied by diversion from the Kosi Basin. Diversion has been considered in several areas for maximum water supply, including diversion from the Sun Kosi No.1 site to the Kamla River, from Kampu Ghat in the Sun Kosi lower stream to the Trijuga River, from the Kosi High Dam reservoir to the Sapt Kosi lower basin, and from the Tamur River to the eastern Sapt Kosi. Of the above plans, geological conditions for tunnel routes were generally studied for the following:

- Sun Kosi Diversion Plan
- Sapt Kosi West Diversion Plan
- Sapt Kosi East Diversion Plan

The Master Plan for the diversion scheme and distribution of the Main Boundary Fault is presented in FIG. 3-35. Geological considerations which are essential to tunnel planning are summarized in TABLE 3-18 below.

TABLE 3-18 GEOLOGICAL SURVEY ITEMS FOR TUNNEL PLANNING

Geological Survey Item	Purpose of Study
Surface deposits	to check landslide and collapse near the planned tunnel entrance and in the thin space of the overburden
Rock quality	to check aggregate and determine construction method
Geological structure	to check characteristics of alteration zone, folding structure, fault shear zone, etc.
Surface water & groundwater	to determine leakage occuring within the tunnel

As there is no detailed plan drawing of the tunnel exit or entrance, study of the just point was not possible. However, field survey of rock quality and geology along the tunnel line was carried out, and study of the Main Boundary Fault, which concerns the entire tunnel diversion scheme, was particularly emphasized. The said fault was studied at the following 3 locations.

Location 1 Barakshetra downstream from the Sapt Kosi High Dam
Location 2 Kampu Ghat in the lower Sun Kosi
Location 3 Upper Tawa Khola, an affluent of the Kamla River

(1) Schematic Geological Condition of the MBF

The MBF at Locations 1 and 2 has a strong shear zone accompanied by clay. At the former, there is also intrusive basic igneous rock which follows a weak line. Particularly at Location 2, the MBF is wider than 100m and the sandstone of the Siwalik layer below is consequently fractured and interbedded with clay 50m in width. In addition, a small landslip is visible on the left bank of the Sun Kosi River extending for 4-5km. The Siwalik layer at the footwall of the MBF has a shear zone of several 100m accompanied by a small fault along the footpath in downstream Barakshetra (FIG. 3-36).

At Location 3, where the Maruwa Khola branches from the Tawa Khola in the Kotari Village, the width of the MBF is extremely narrow. Bounded by the fault, the footwall is formed by the Siwalik layer (fine to medium grade sandstone) and is a well-consolidated hard layer. The hanging wall is formed of black phyllite with chert and has a strong fold. The maximum width of the MBF at this point is estimated at about 10m which is much narrower in comparison with that at the other 2 locations. (See FIG 3-37)

The above observations indicate that, although the MBF is formed by S-N stress, there are variations in stress absorption depending on the location. In Locations 1 and 2, tension action is strong, resulting in the intrusion of igneous rock through the opening in a wide shear zone.

In Location 3, on the other hand, compression stress creates an absorption zone in the form of lateral slide and consequently width of the shear zone is narrow. (See FIG 3-37) A schematic drawing of the above is presented in FIG. 3-38 below.

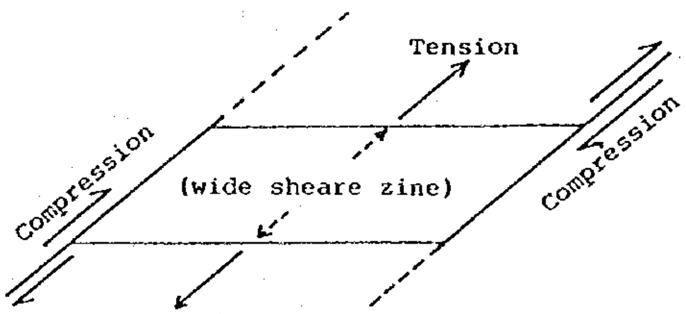


FIG. 3-38 **FAULT SYSTEM**

In summary, the MBF has a combined structure with both tension and compression zones depending on location, and is considered to be an echelon fault series.

(2) Considerations in Diversion Planning

The Sun Kosi Diversion tunnel route is located along the compression zone of the MBF and width of the shear zone is a narrow 10m. Potential influence of the MBF on diversion tunnel planning at the intake site for the Sun Kosi No.1 dam is considered slight.

The Trijuga Diversion scheme consists of intake of water from the Kosi High Dam reservoir at a point near Kampu Ghat which will subsequently be conveyed by tunnel to the Trijuga River and used to irrigate the Sapt Kosi west bank. The MBF main structure, with a wide clay and shear zone, is distributed along the Sun Kosi left bank, and is expected to have negligible influence at the intake site. However, comparative study of direct intake from the Kosi High Dam should also be undertaken.

Intake for diversion to the Sapt Kosi East downstream area, excluding direct intake from the Sapt Kosi High Dam, will be from the Tamur River. Existing dam plans include the Mulghat Dam Project and a series of other plans for Tamur Dams. Study of the intake tunnel routes of the same indicates that thorough and careful planning will be required in anticipation of numerous faults which cross the tunnel route (including the MBF), complex stratigraphy, and substantial distance between intake and irrigation sites which will require a long tunnel extension.

TABLE 3-9

LIST OF ROCK TESTS

Sample No.	Sampling Depth	Apparent Specific Gravity			1/ Wab	2/ ef	3/ Wc	Unit Weight	Velocity of Super Sonic Wave				Compressive Strength	8/ Esc	Static Poisson's Ratio
		Natural	Dry	Satu-rated					4/ VP	5/ VS	6/ Edc	7/ dc			
	m - m				(%)	(%)	(%)	(g/cm2)	(km/S)	(km/S)	kg/cm2x10^5		δu (kg/cm2)	kg/cm2x10^5	sc
Su-2															
B-1 1	1.10- 1.15	2.71	2.70	2.72	0.69	1.86	0.38	2.693	4.06	2.10	3.20	0.32	411.6	3.61	0.16
2	28.60-28.80	2.74	2.74	2.74	0.30	0.83	0.19	2.727	4.77	2.48	4.50	0.32	960.8	3.39	0.27
3	42.35-42.55	2.71	2.71	2.72	0.40	1.07	0.25	2.711	4.91	2.32	4.04	0.36	554.0	1.95	0.13
B-2 4	29.20-29.55	2.73	2.72	2.73	0.35	0.97	0.20	2.724	4.81	2.53	4.67	0.31	1,303.1	3.65	0.29
5	49.45-49.55	2.74	2.73	2.74	0.33	0.90	0.19	2.726	5.01	2.54	4.78	0.33	999.7	2.99	0.39
B-3 6	2.30- 2.50	2.75	2.75	2.76	0.29	0.81	0.17	2.742	4.57	2.47	4.41	0.30	900.6	3.68	0.33
7	24.50-24.70	2.65	2.63	2.66	1.47	3.85	0.97	2.629	3.25	1.68	1.99	0.32	36.1	0.83	0.23
8	49.65-49.75	2.72	2.71	2.72	0.48	1.30	0.30	2.699	3.00	1.84	2.24	0.20	201.5	2.38	0.35
Su-3															
B-1 9	19.55-19.70	2.78	2.79	2.28	0.15	0.40	0.02	2.731	4.21	2.15	3.63	0.33	425.6	3.86	0.10
10	27.55-27.70	2.75	2.74	2.75	0.18	0.48	0.03	2.728	4.11	2.26	3.68	0.34	431.8	3.77	0.13
Su-3															
B-2 11	43.20-43.35	2.77	2.76	2.77	0.16	0.44	0.02	2.725	4.37	2.26	3.74	0.32	447.3	3.73	0.12
Ta-3															
B-1 12	16.10-16.35	2.60	2.60	2.62	0.48	1.19	0.21	2.660	3.78	2.15	2.86	0.23	385.3	2.70	0.23
13	30.40-30.60	2.67	2.66	2.67	0.44	1.17	0.20	2.661	3.88	2.08	3.05	0.30	550.6	2.93	0.20
14	35.00-35.20	2.70	2.68	2.70	0.41	1.15	0.16	2.683	3.95	2.21	3.11	0.28	582.4	3.22	0.18
Ta-3															
B-2 15	24.70-25.00	2.75	2.74	2.75	0.51	1.21	0.23	2.673	4.03	2.52	3.23	0.25	602.8	2.15	0.22
16	37.00-37.25	2.71	2.71	2.71	0.55	1.27	0.25	2.665	3.80	2.03	2.95	0.31	503.6	2.56	0.23
Ar-3															
B-1 17	20.10-20.35	2.67	2.67	2.67	0.30	0.80	0.09	2.683	2.69	1.53	1.62	0.62	260.2	1.19	0.12
Ar-3															
B-2 18	27.40-27.65	2.68	2.67	2.68	0.27	0.81	0.08	2.684	2.71	1.60	1.83	0.28	276.5	1.21	0.15

1/: Water Absorption Coefficient
2/: Net Porosity
3/: Water Content
4/: Velocity of Primary Wave
5/: Velocity of Secondary Wave
6/: Dynamic Modulus of Elasticity
7/: Dynamic Poisson's Ratio
8/: Static Modulus of Elasticity

TABLE 3-12

SOILE TESTS OF CORE MATERIALS AT SU.3 SITE

Sample No.	Sampling Date	Permeability coefficient cm/sec	Specific Gravity of Solids (Gs)	Native Water Content Wt %	Grading Distribution							Consistency Limit			Compaction Test		Remarks
					Gravel %	Sand %	Silt %	Clay %	Max. Grain Size m/m	Uc.	Uc'	Liquid Limit Wl %	Plasticity Limit Wp %	Plasticity Index Ip	W opt %	d max. (g/cm3)	
012905	1985 Jan. 29	-	2.76	-	1.5	22.5	35.0	41.0	9.52	-	-	-	-	-	12.56	1.93	
013002	" Jan. 30	-	2.63	-	11.5	49.9	30.0	9.0	9.52	178.6	0.09	-	-	-	10.05	1.97	
013006	- do -	-	2.74	-	23.4	53.7	15.9	7.0	9.52	314.3	4.06	-	-	-	9.50	2.05	
080401	1985 Aug. 4	2.12×10^{-5}	2.73	13.17	33.14	41.02	25.84	-	19.1	-	-	25.50	18.18	7.32	9.70	2.04	
080402	- do -	1.79×10^{-6}	2.75	3.75	2.44	69.24	28.32	-	9.52	-	-	23.20	19.79	3.41	10.60	1.96	
080403	- do -	4.78×10^{-6}	2.68	1.79	43.06	29.18	27.76	-	19.1	-	-	21.70	18.83	2.87	11.50	2.04	
080404	- do -	8.61×10^{-6}	2.73	3.35	0.90	52.28	46.82	-	9.52	-	-	21.80	17.70	4.10	9.50	2.04	
080405	- do -	4.02×10^{-6}	2.64	6.88	45.68	16.62	37.70	-	25.4	-	-	23.70	15.05	8.65	10.90	1.96	
080501	1985 Aug. 5	1.17×10^{-5}	2.68	4.04	9.70	65.18	25.12	-	19.1	-	-	20.50	17.39	3.21	9.00	2.10	

TABLE 3-14 ESTIMATED GEOLOGICAL CONDITIONS OF SEISMIC VELOCITY LAYERS (at TM.3 site)

a) Dam Site

Velocity Layer	Seismic Velocity (km/sec)	Corresponding Geology
1st	0.3 - 0.5	Topsoil and talus
2nd	0.8 - 1.1 1.1 - 1.2	Talus gravels and sands and/or loose gravels and sands
3rd	1.6 - 1.8 1.8 - 1.9	Middle weathered zone, little consolidated gravels and sand
4th	2.6 - 2.8	Well consolidated gravels and sand and/or lower weathered zone
5th	4.2 - 4.3 4.5 - 4.6	Basement rock (Fresh layer)
		Low velocity layer and/or shear zone

b) Powerhouse

Velocity Layer	Seismic Velocity (km/sec)	Corresponding Geology
1st	0.3 - 0.5	Topsoil talus
2nd	0.6 - 0.8 1.2	Talus or upper weathered zone gravels and sands
3rd	1.6 - 1.8	Middle weathered zone and/or little consolidated gravels and sands
4th	2.6 - 2.8	Lower weathered zone and/or well consolidated gravels and sands
5th	5.0	Basement rock: fresh layer
		Low velocity layer and/or shear zone

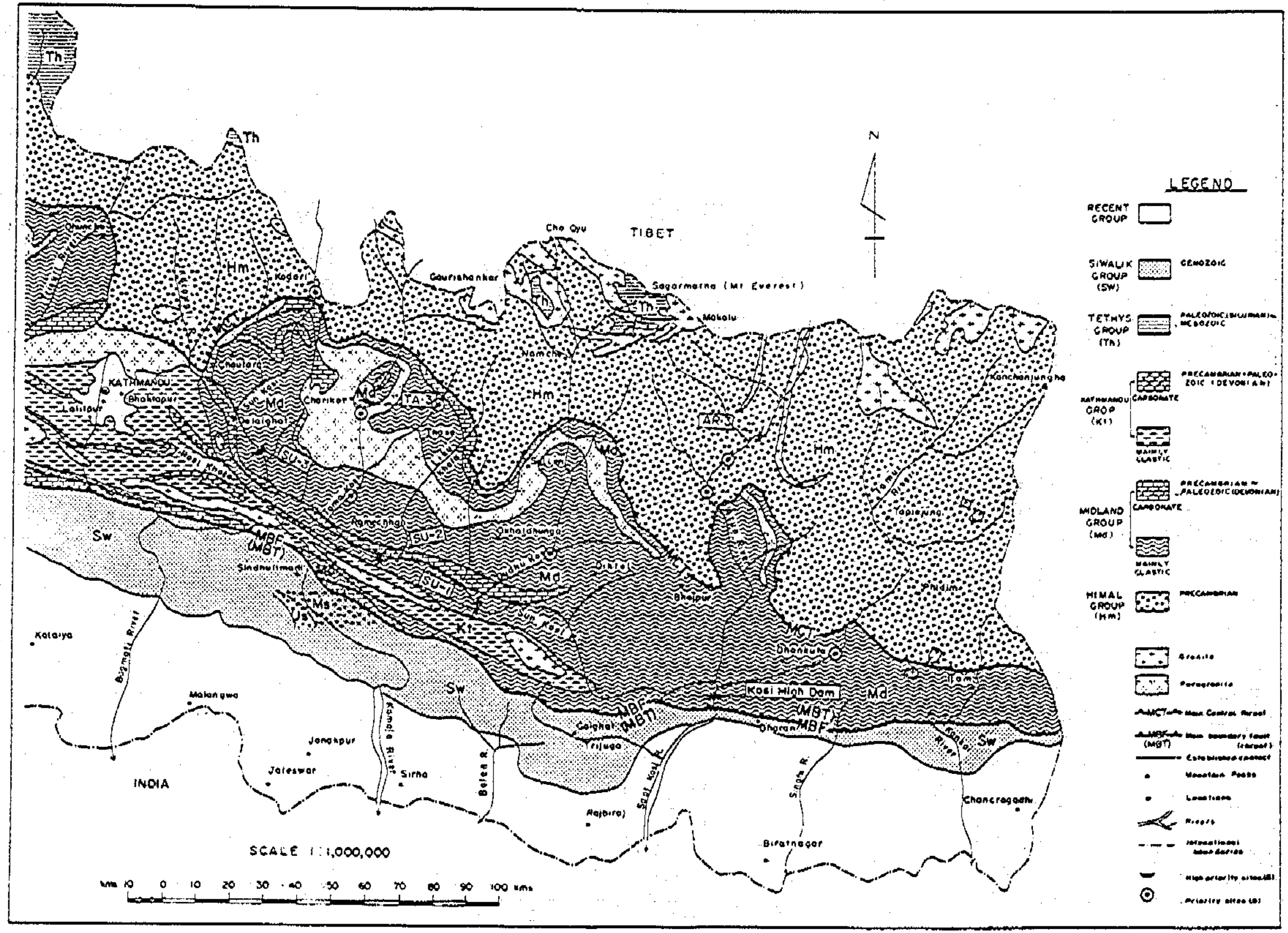


FIG. 3-2 GEOLOGICAL MAP OF EASTERN NEPAL

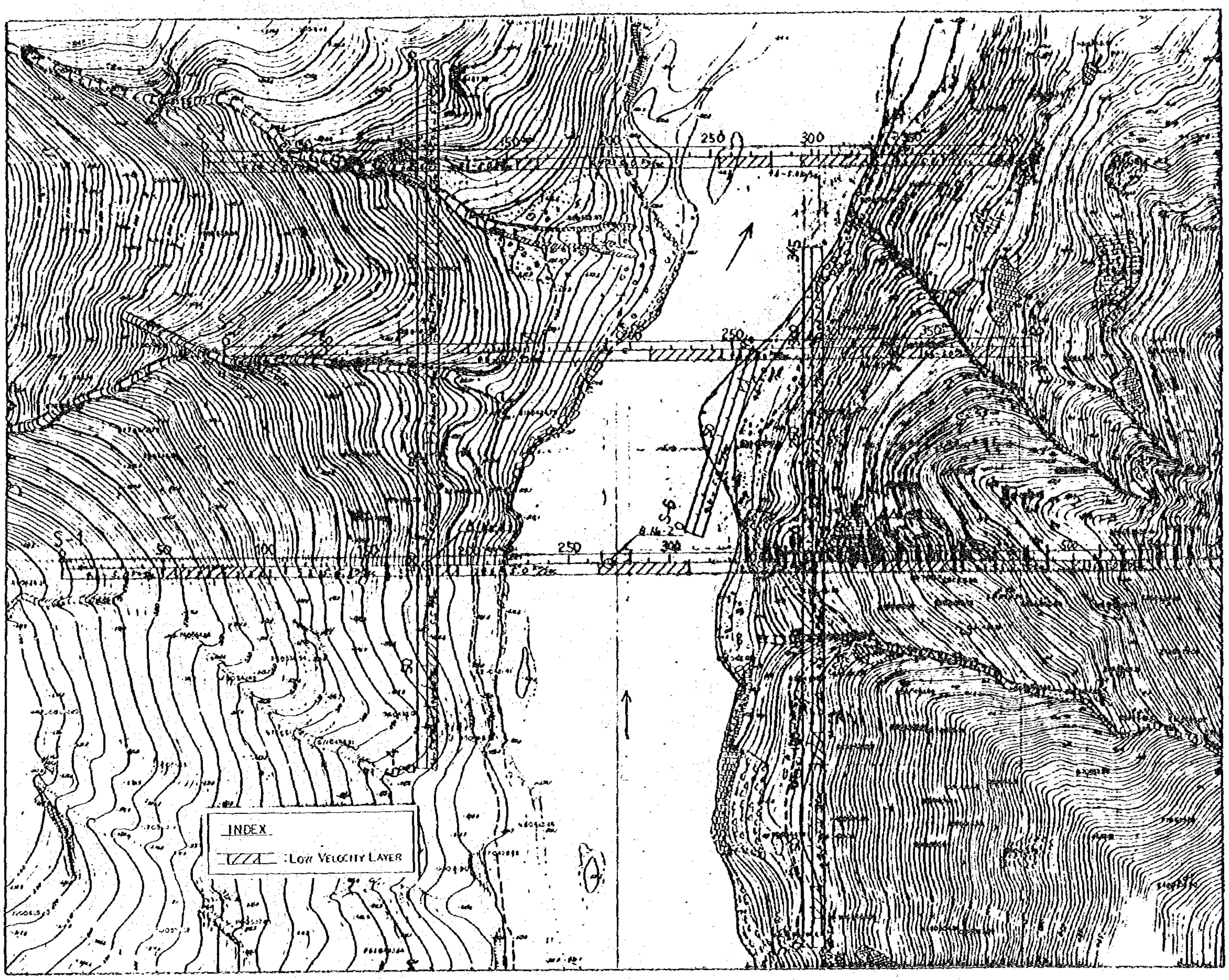


FIG. 3-7 LOCATION MAP OF SEISMIC SURVEY LINES AND BORING POINTS AT SU.2 SITE

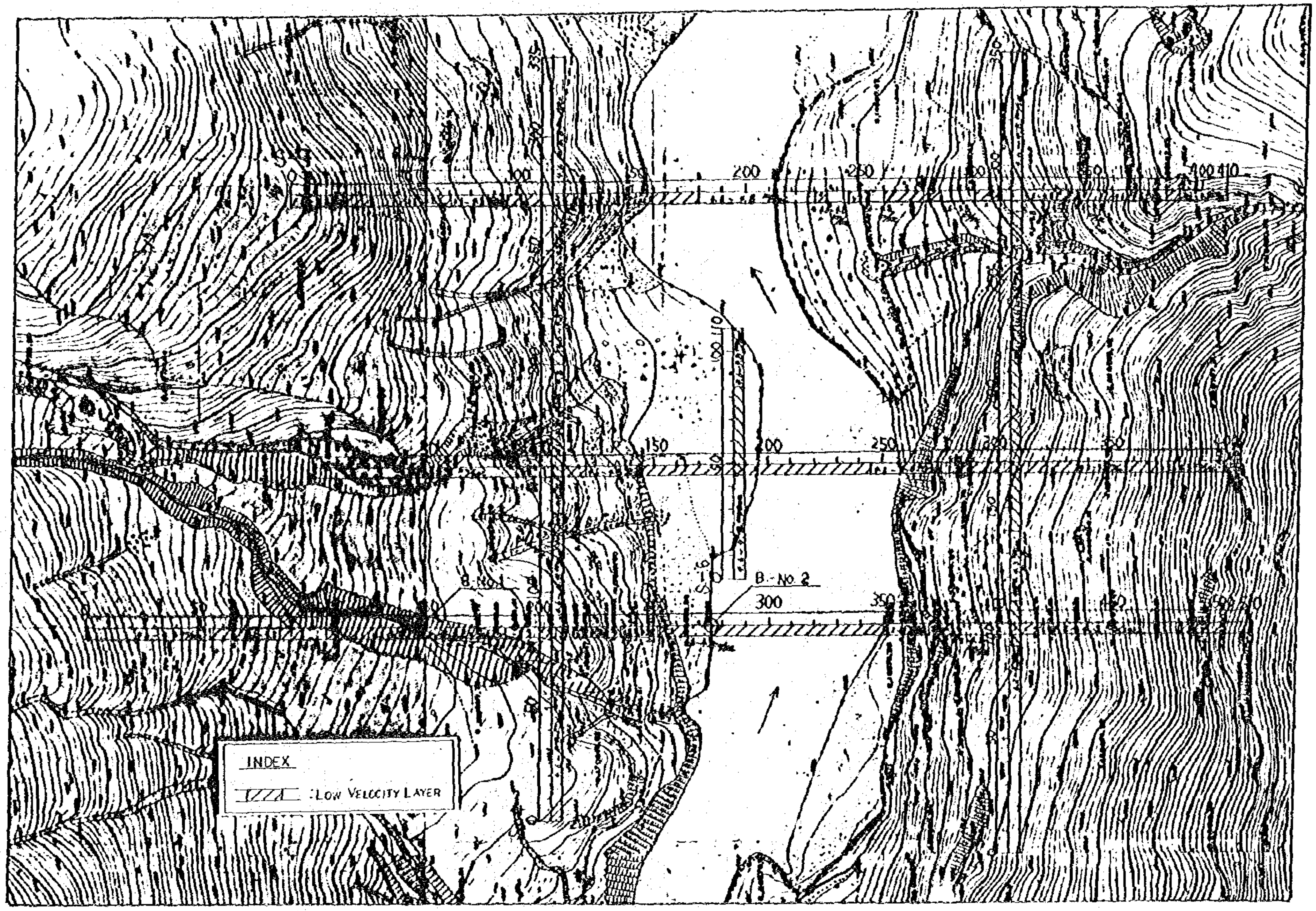
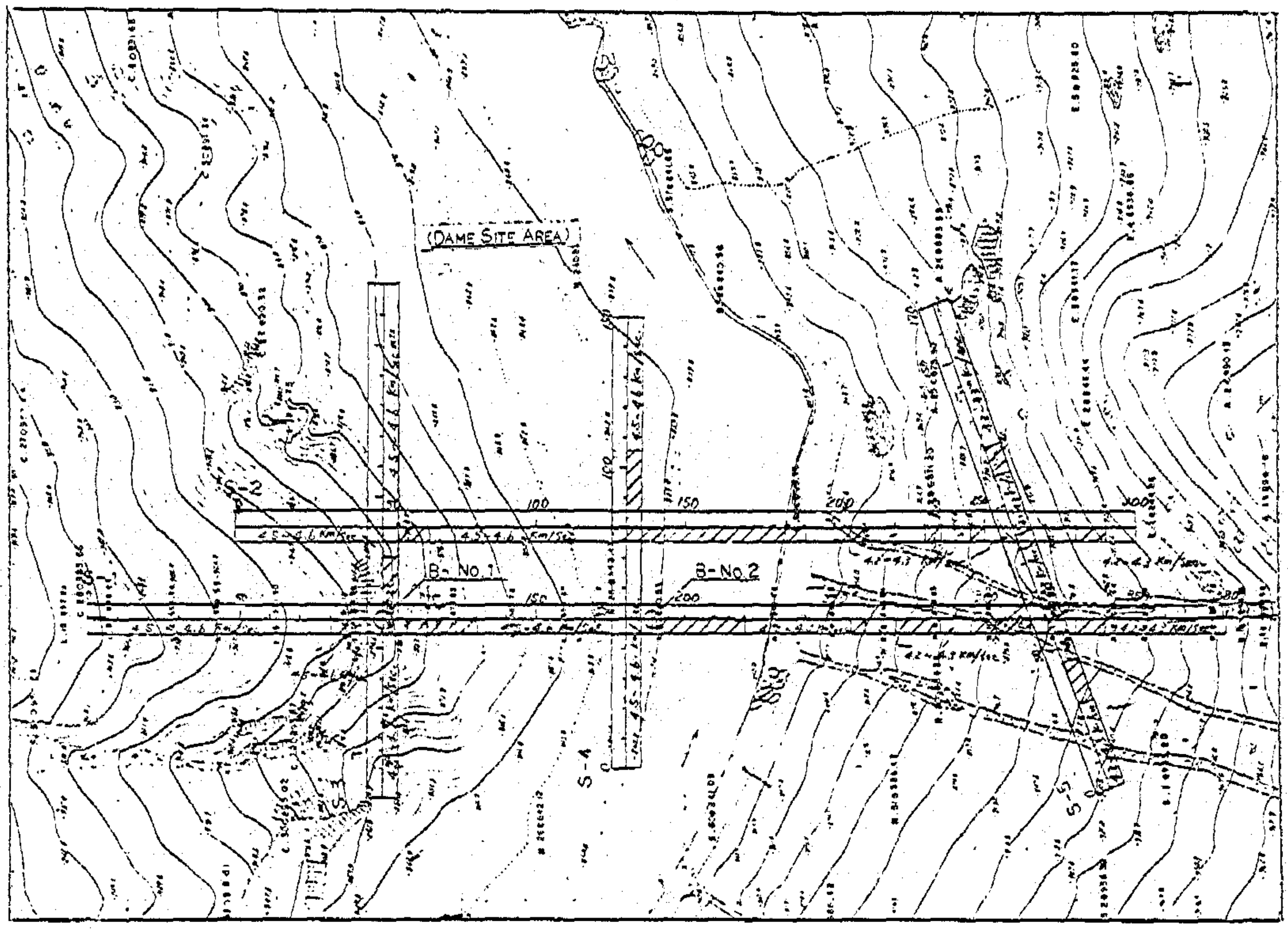


FIG. 3-8 LOCATION MAP OF SEISMIC SURVEY LINES AND BORING POINTS AT SU.3 SITE



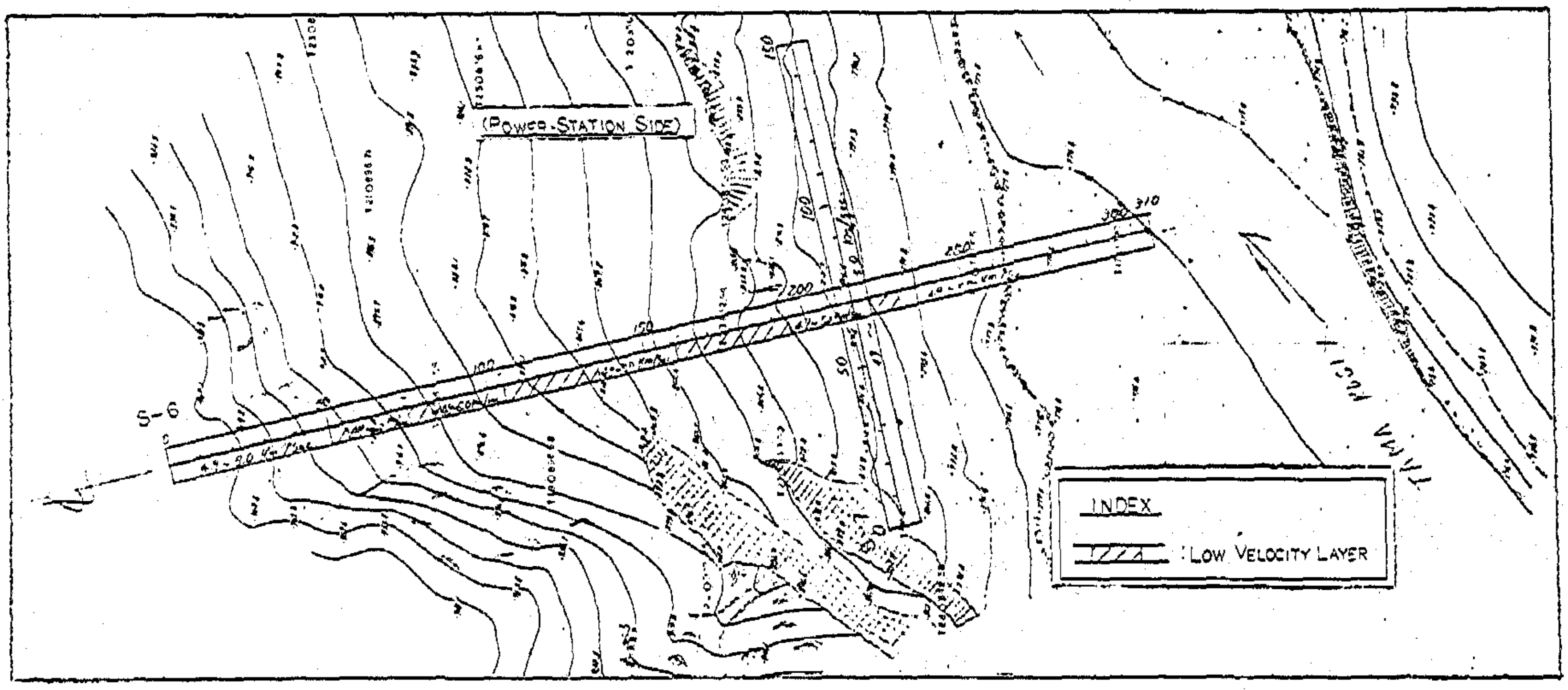


FIG. 3-9 LOCATION MAP OF SEISMIC SURVEY LINES AND BORING POINTS AT TM.3 SITE

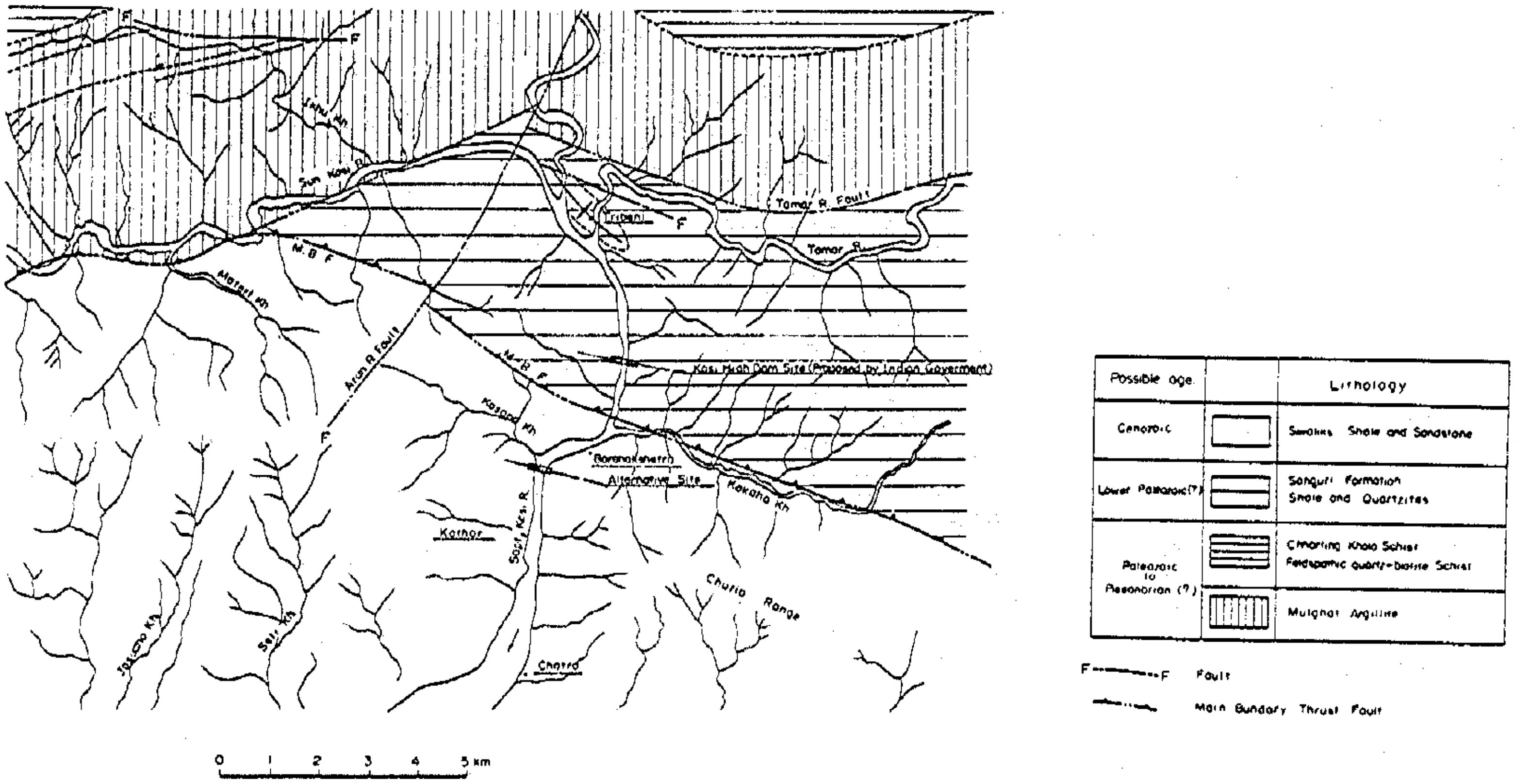
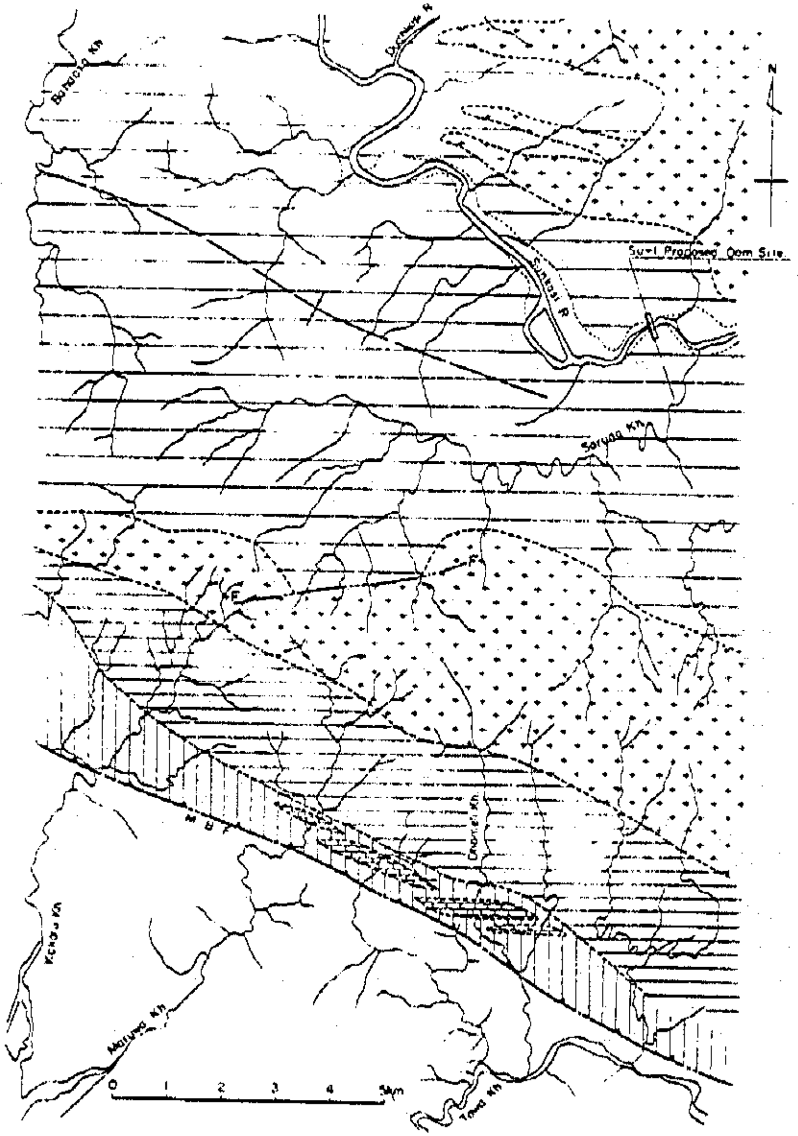


FIG. 3-10 GEOLOGICAL MAP OF SAPT KOSI AREA



Possible age	Formation Name	Symbol	Lithology
Middle Miocene	Lower Siwaliks — F		Sandstone, with interbedded clays
Tertiary	Younger Granitic — Complex		Granitic gneiss, porphyloblastic
Cambrian	Bhimphedi F		Biotite-schist, with interbedded marble and calc-silicate Biotite-schist, coarse-textured with a few interbeds of quartzite
Precambrian (?)	Suporitan F		phyllite with interbedded carbonaceous shale and limestone

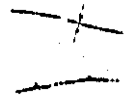


FIG. 3-11 GEOLOGICAL MAP OF SUN KOSI NO.1 SITE

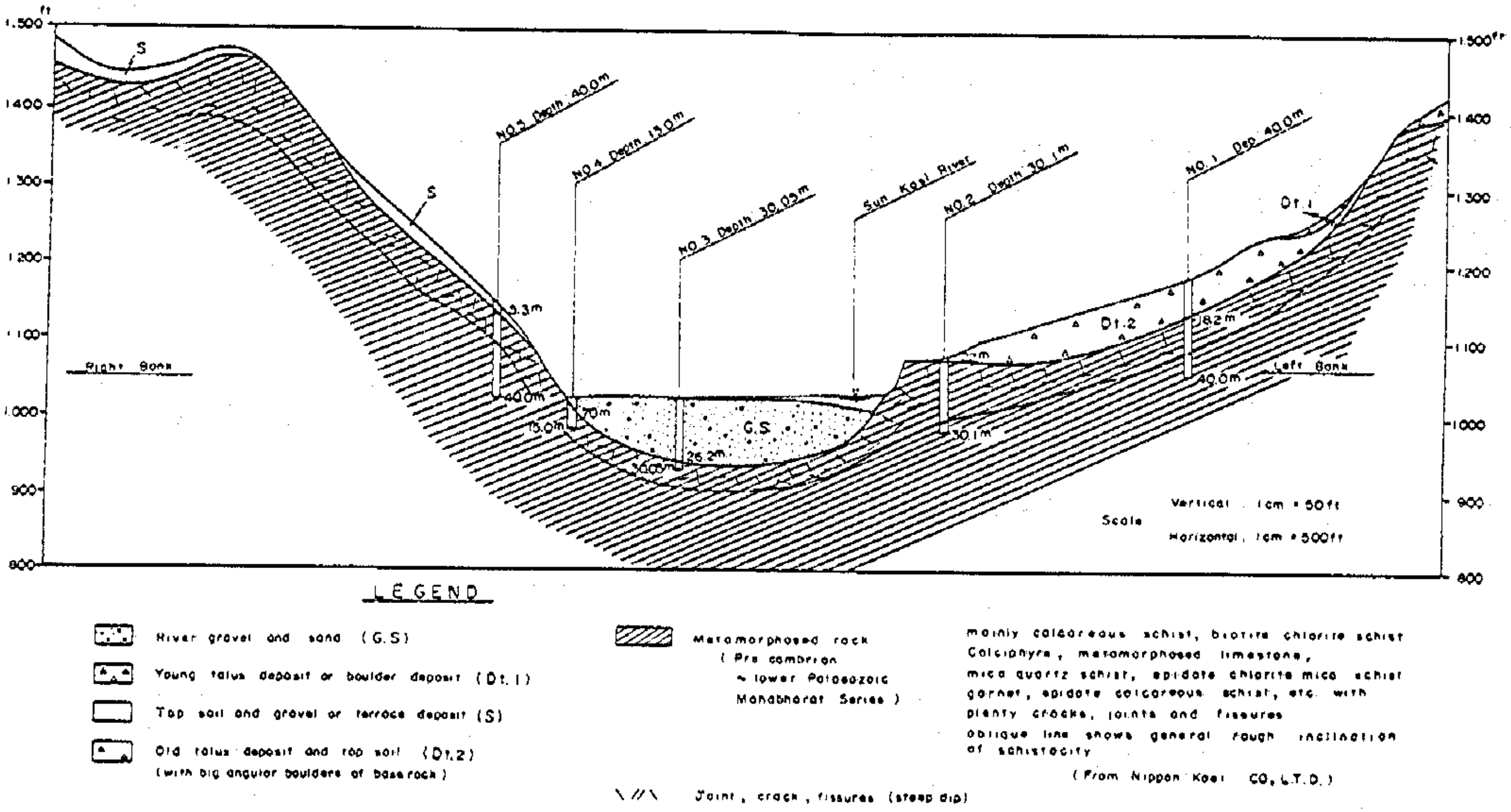


FIG. 3-12 **GEOLOGICAL PROFILE ALONG SUN KOSI NO.1 DAM AXIS**

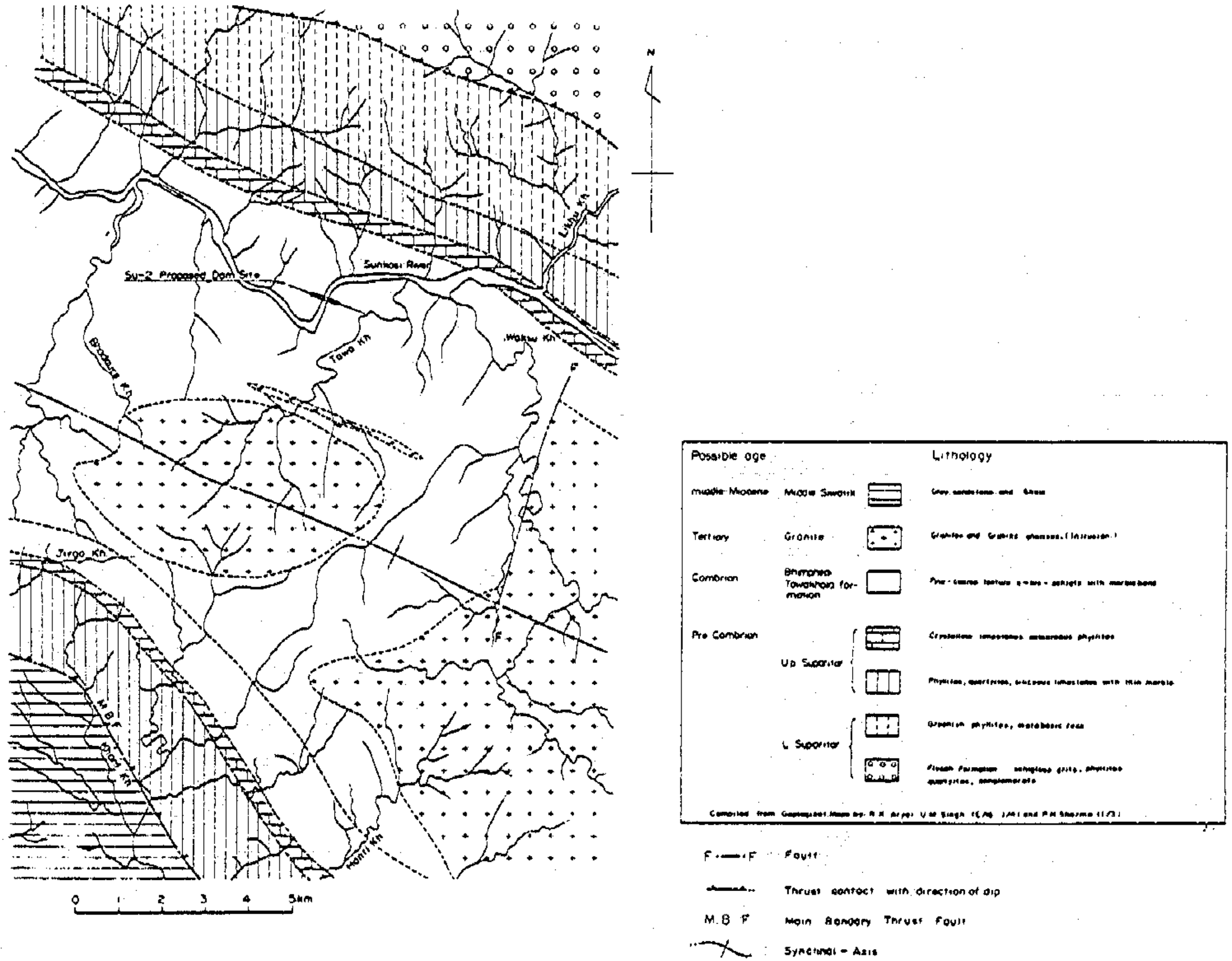


FIG. 3-13 GEOLOGICAL MAP OF SUN KOSI NO.2 SITE

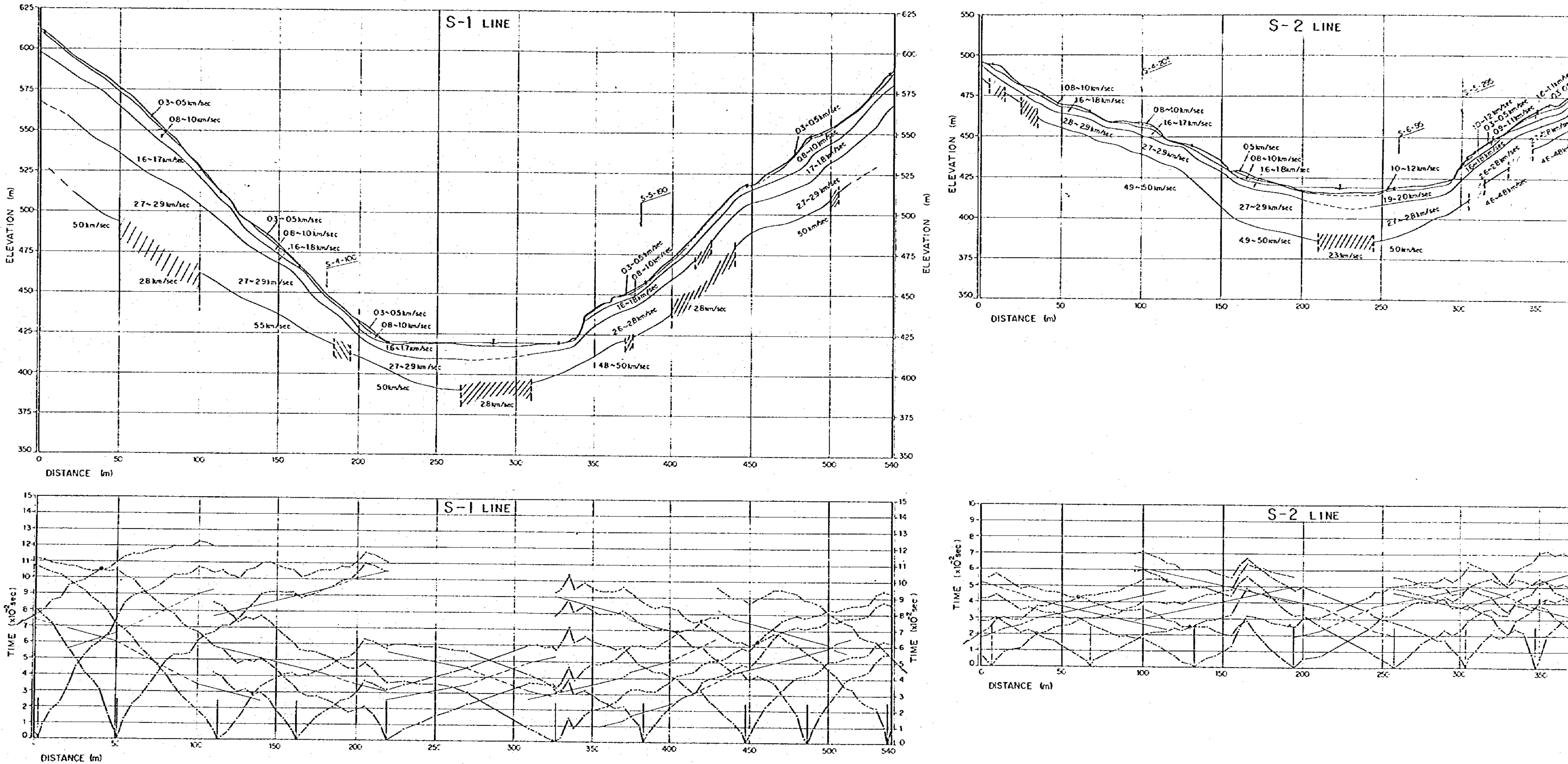


FIG. 3-14 CROSS-SECTIONS BY SEISMIC SURVEY AT SU.2 SITE

(1 of 3)

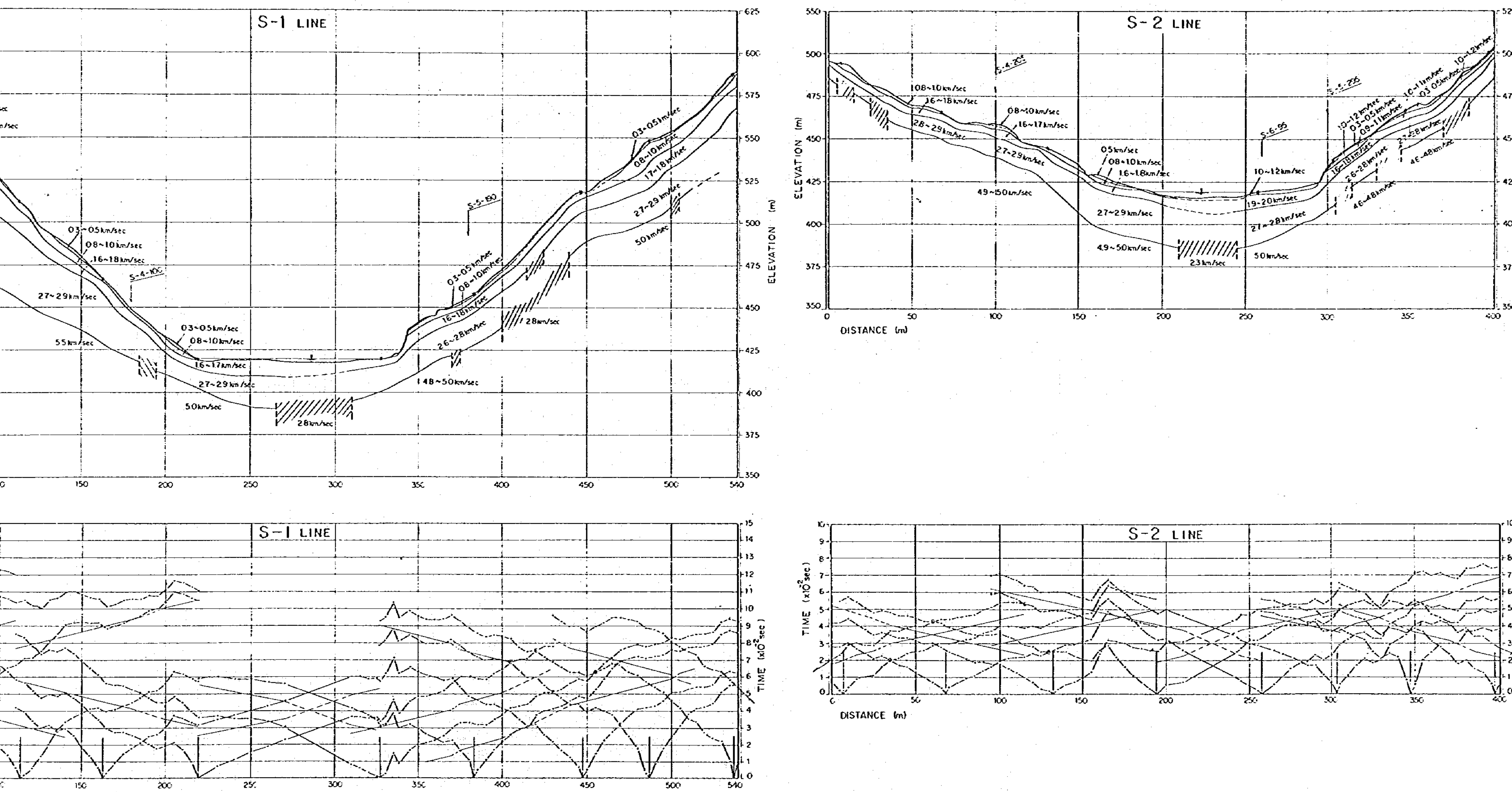


FIG. 3-14 CROSS-SECTIONS BY SEISMIC SURVEY AT SU.2 SITE
(1 of 3)

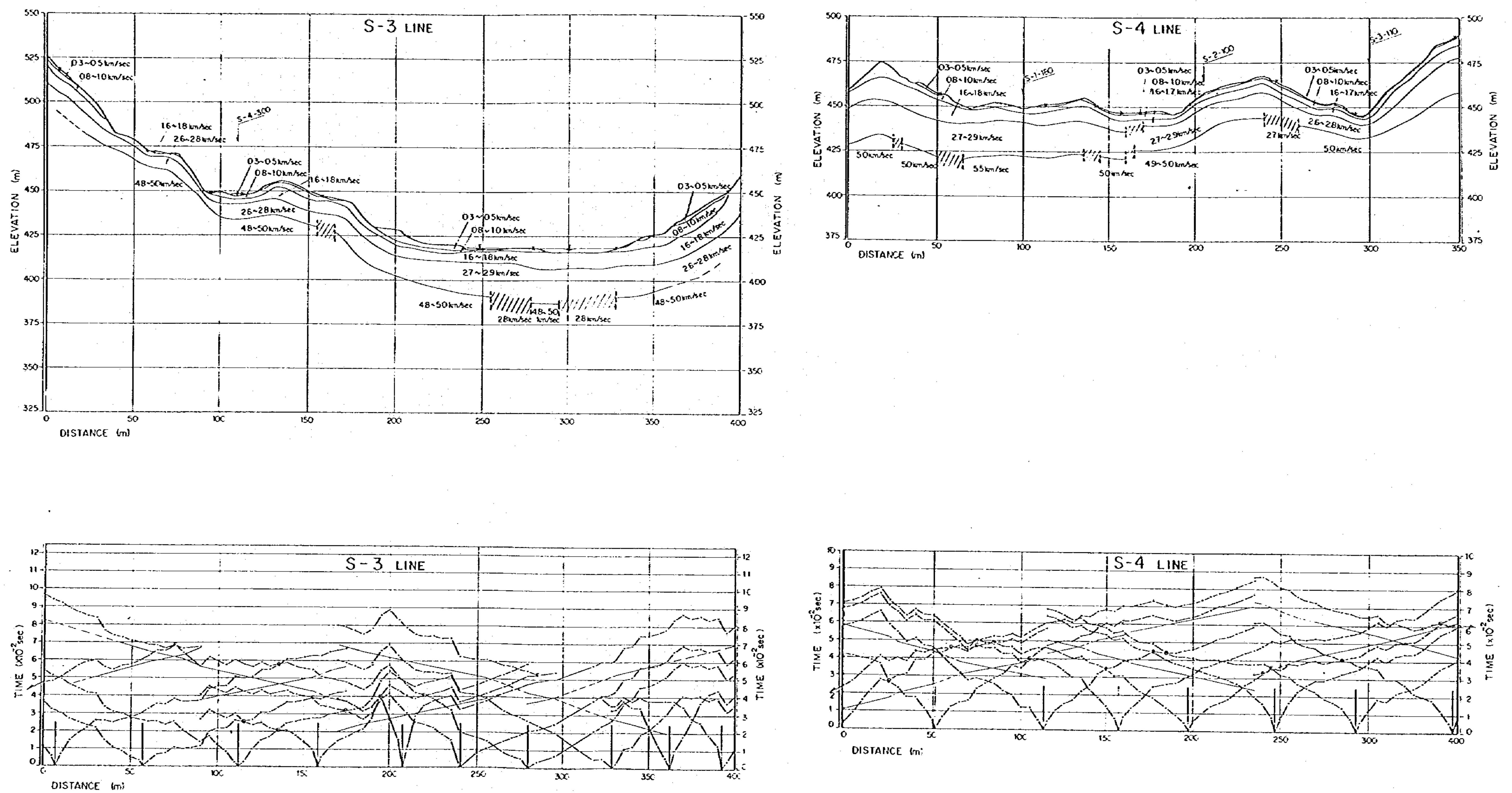


FIG. 3-14 CROSS-SECTIONS BY SEISMIC SURVEY AT SU.2 SITE

(2 of 3)

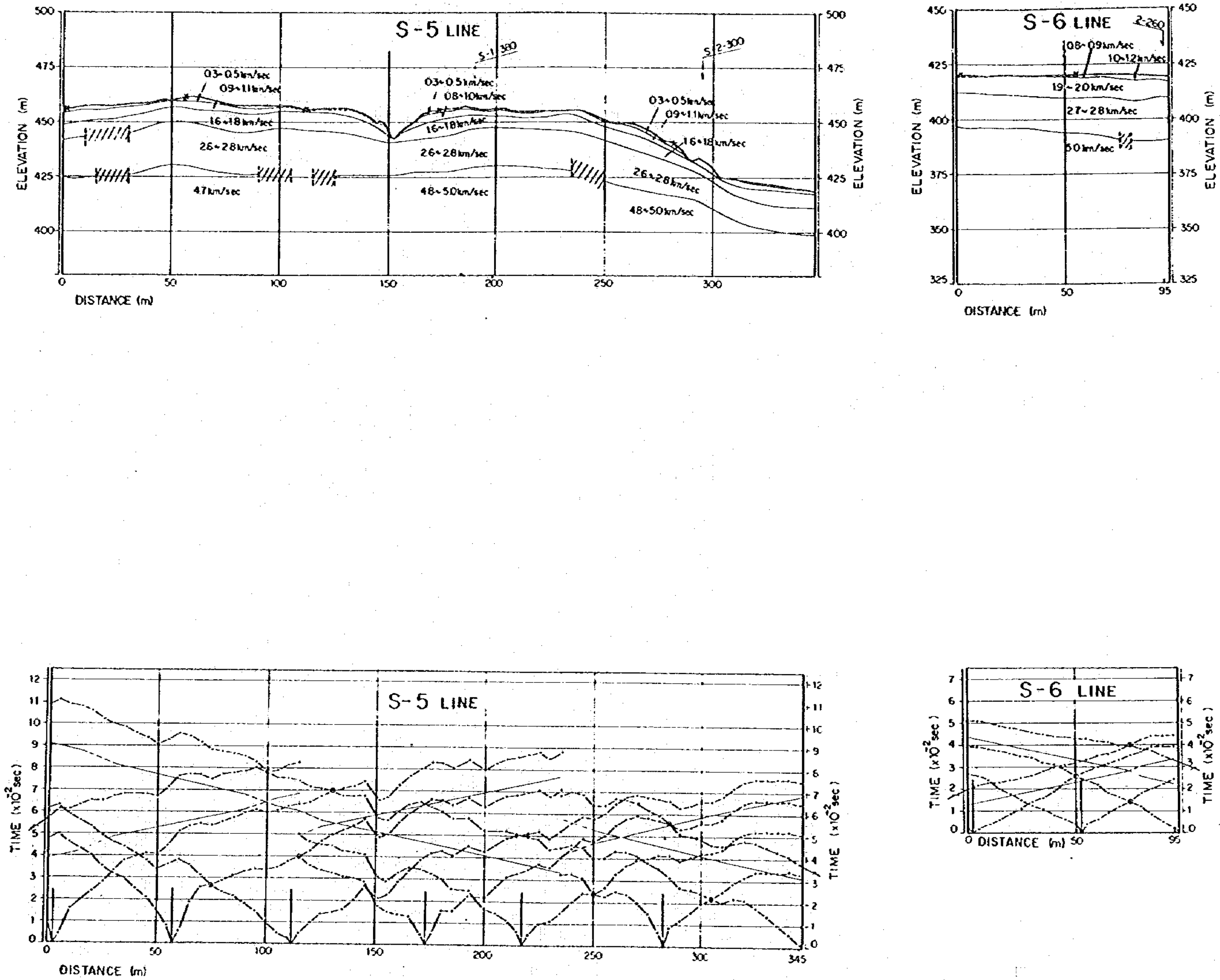


FIG. 3-14 CROSS-SECTIONS BY SEISMIC SURVEY AT SU.2 SITE
(3 of 3)

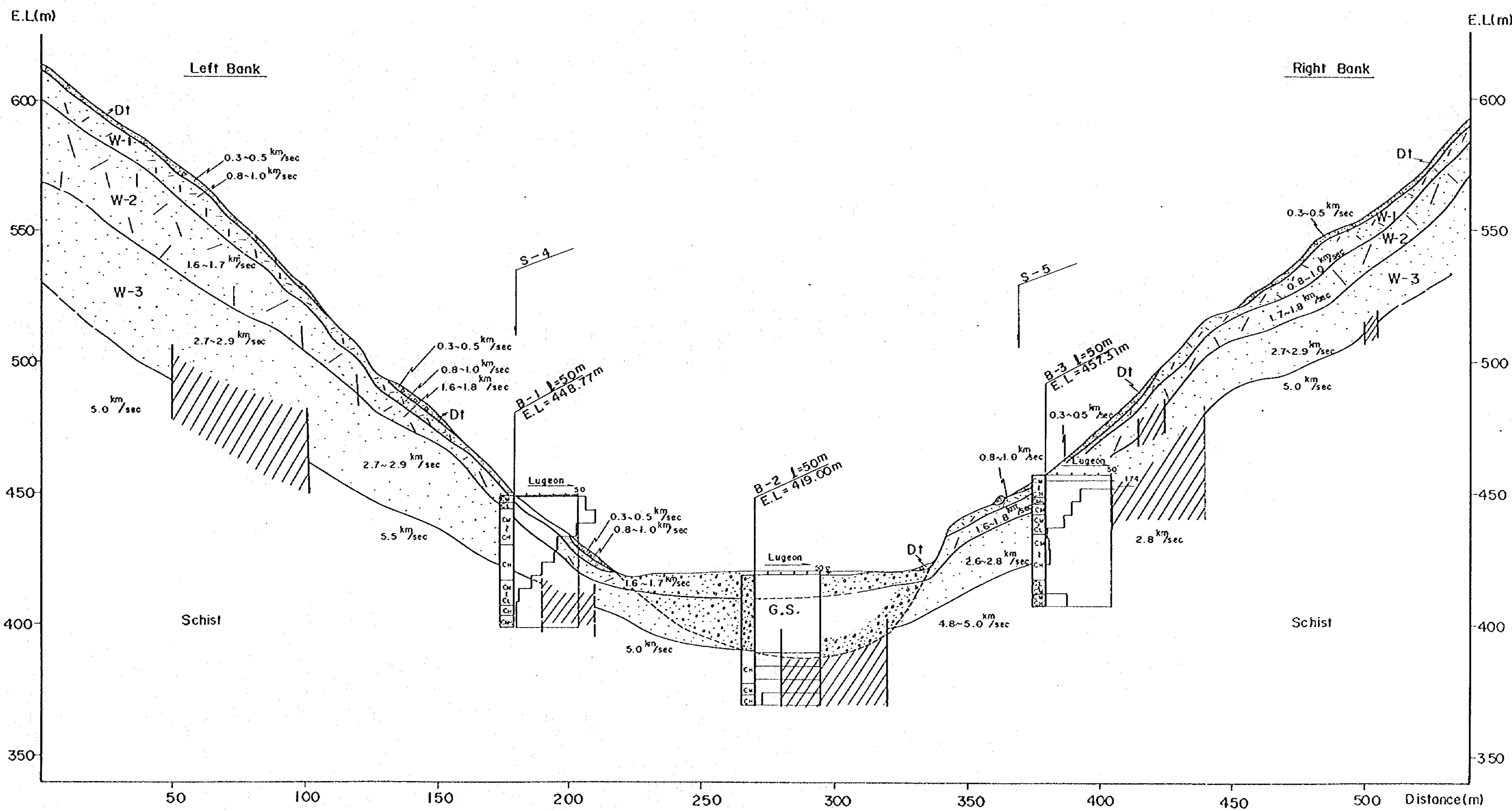
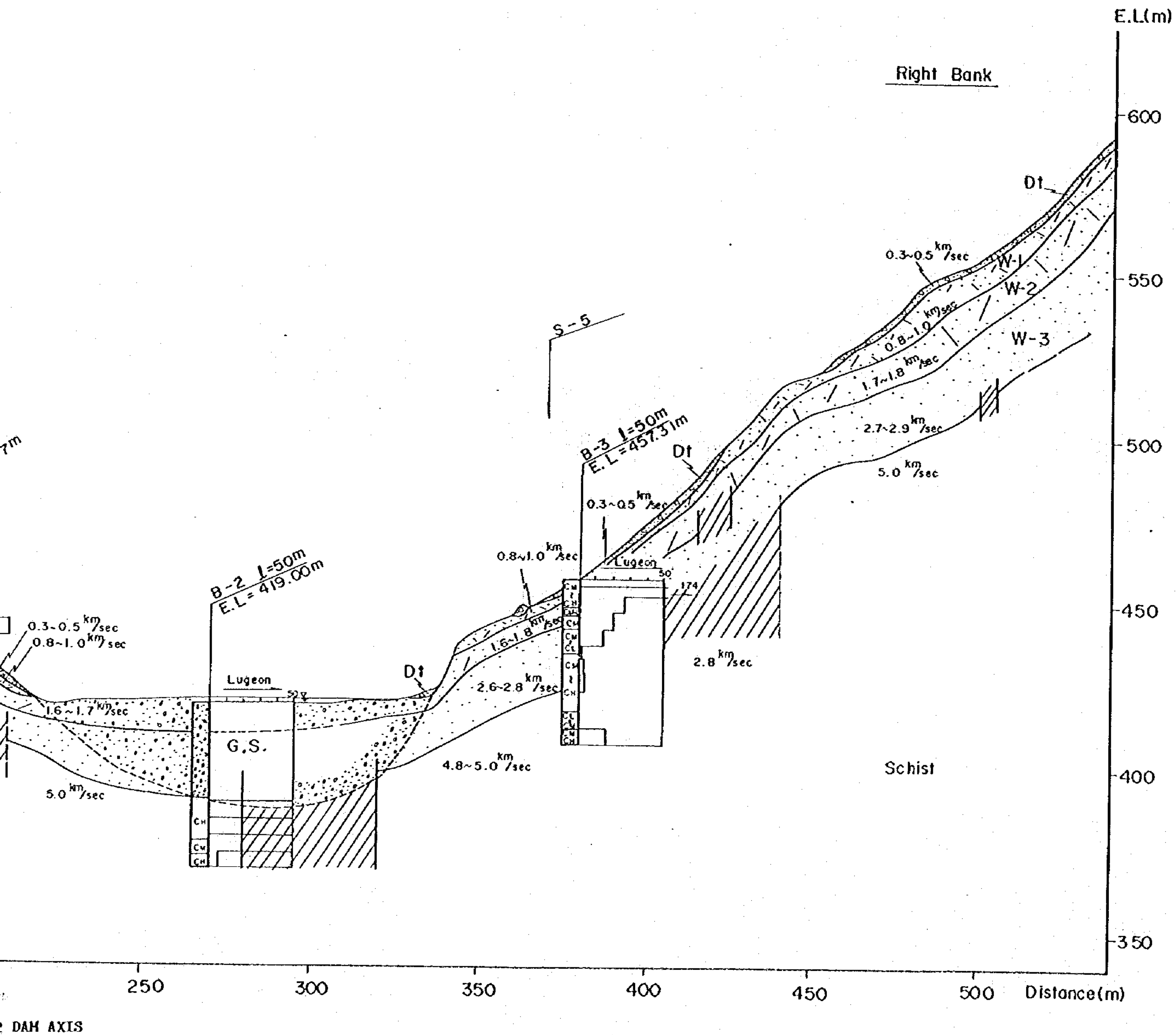


FIG. 3-16 GEOLOGICAL CROSS-SECTIONAL DIAGRAM ALONG SU.2 DAM AXIS



Index

- Talus deposits (Dt)
- Gravels Sands River Deposits (G.S) } Quateruary
- Upper weathering zone (W-1)
- Middle weathering zone (W-2)
- Lower weathering zone (W-3)
- Low velocity layer in Fresh Layer } Cambrian Period, Bhimphidi – Tawakholo F., Mainly fine-coarse quartz-biotite schist

Estimable geological conditions of seismic velocity layers

Velocity layer	Seismic velocity	Correspouding with geology
1st	0.3~0.5 km/sec	Top soil and Talus
2nd	0.8~1.2 km/sec	Talus and Gravels and Sand and/or Upper weathering zone (W-1)
3rd	1.6~2.0 km/sec	Little cousolidated Gravels and Sands and/or Middle weathering zone (W-2)
4th	2.6~2.9 km/sec	Well cousolidated Gravels and Sands and/or Lower weathering zone (W-3)
5th	4.6~5.0 km/sec Partly 5.5	Basement Rock (Fresh Layer)
	(hatched)	Low velocity layer and/or sheared zone

Examples of Quality Classifications of Rock in Dam Foundations

(1)

Classification	Characteristics
A	Rock-forming minerals[1] are fresh and not weathered or altered. Joints and cracks are very closely adhered with no weathering along their planes. A clear sound is emitted when hammered.
B	Rock-forming minerals are weathered slightly or partially altered, the rock being hard. Joints and cracks are closely adhered. A clear sound is emitted when hammered.
C_H	Rock-forming minerals are weathered but the rock is fairly hard. The bond between rock blocks is slightly reduced and each block is apt to be exfoliated along joints and cracks by strong hammering. Joints and cracks sometimes contain clay and other material which may be coloured by limonite. A slightly dull sound is emitted when hammered.
C_M	Rock-forming minerals are weathered and the rock is slightly soft. Exfoliation of the rock occurs along joints and cracks by normal hammering. Joints and cracks sometimes contain clay and other material. A somewhat dull sound is emitted when hammered.
C_L	Rock-forming minerals are weathered and the rock is soft. Exfoliation of the rock occurs along joints and cracks by light hammering. Joints and cracks contain clay. A dull sound is emitted when hammered.
D	Rock-forming minerals are weathered, and rock is very soft. There is virtually no bond between rock blocks, and collapse occurs at the slightest hammering. Joints and cracks contain clay. A very dull sound is emitted when hammered.

(1) : Except quartz

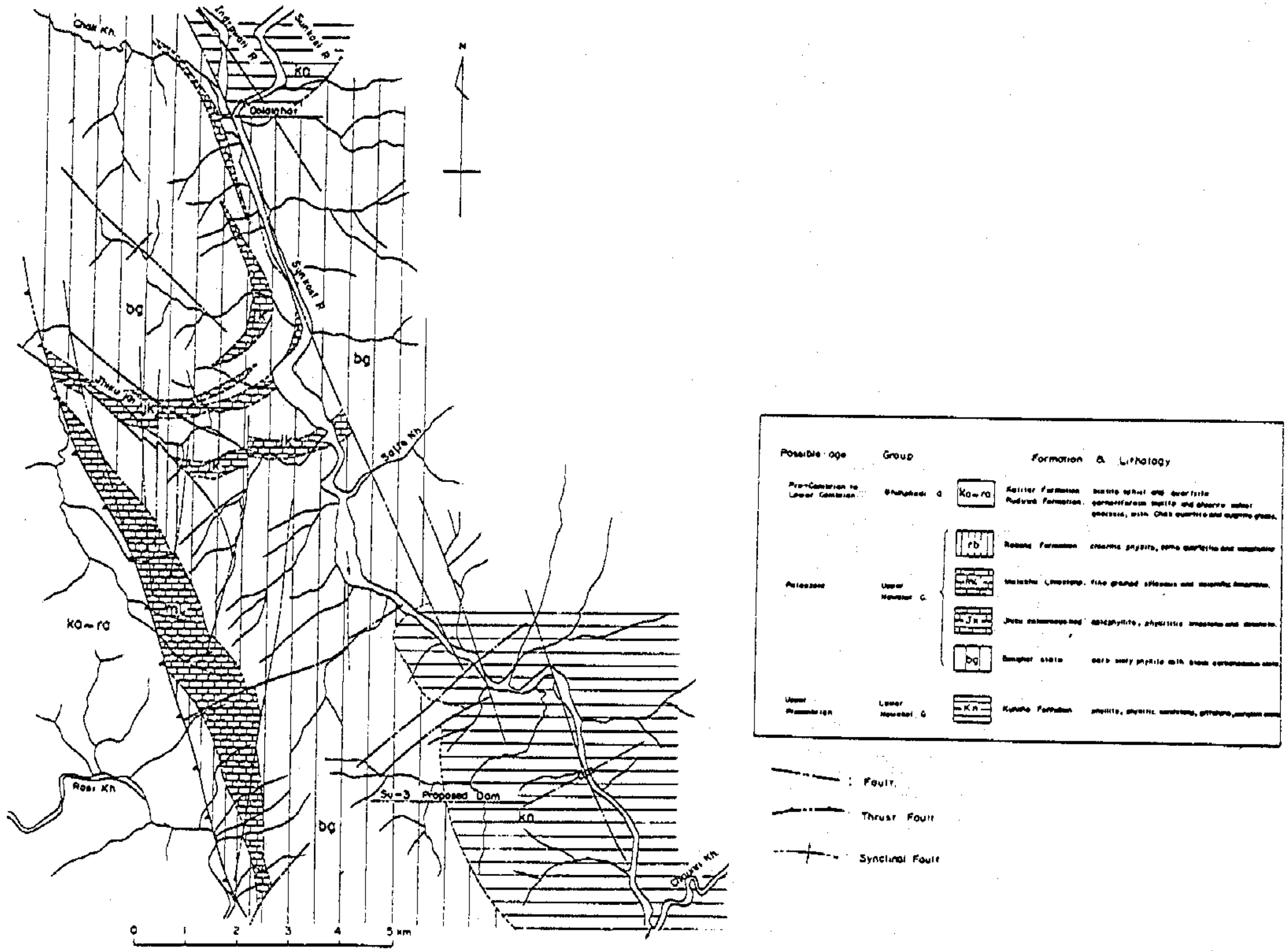


FIG. 3-17 GEOLOGICAL MAP OF SUN KOSI NO.3 SITE

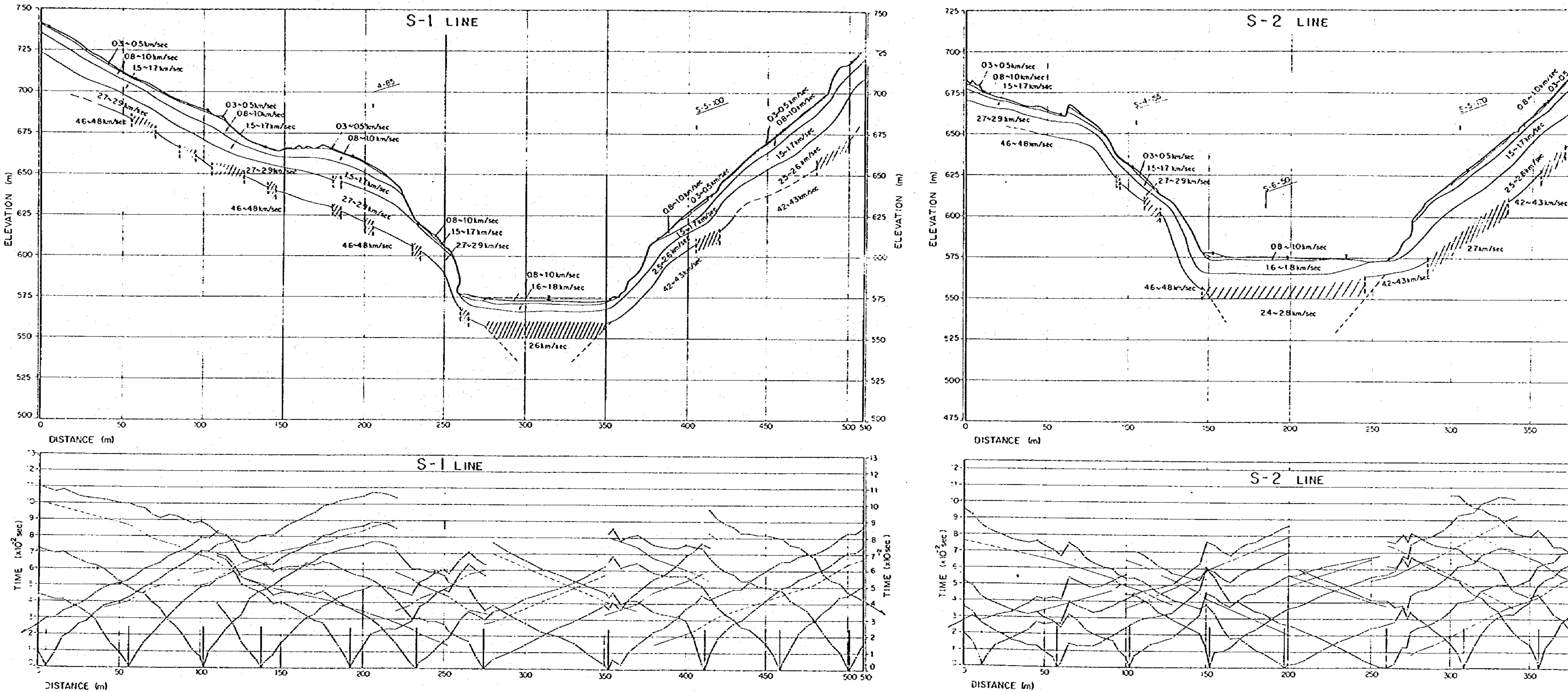


FIG. 3-19 CROSS-SECTION BY SEISMIC SURVEY AT SU.3 SITE

(1 of 3)

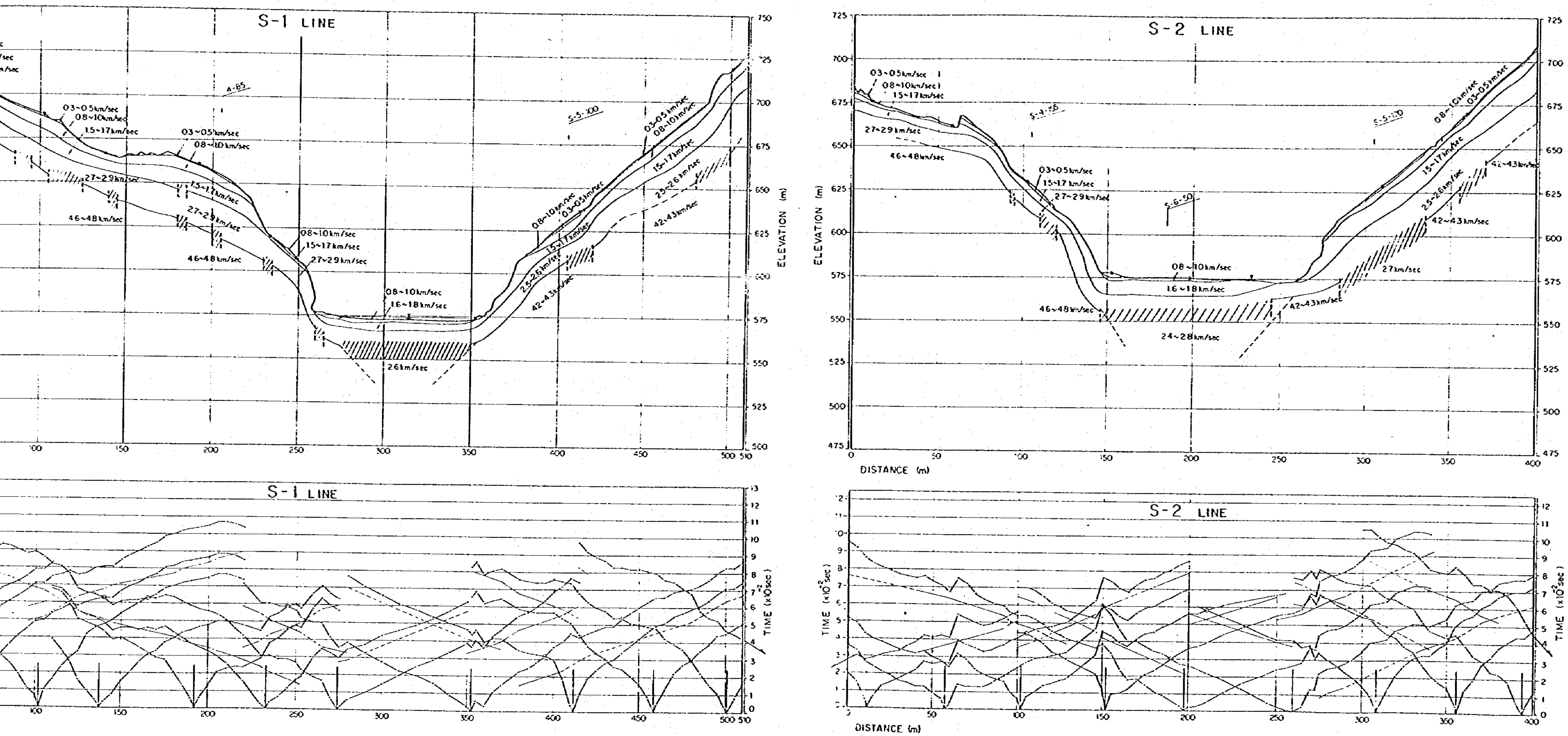


FIG. 3-19 CROSS-SECTION BY SEISMIC SURVEY AT SU.3 SITE

(1 of 3)

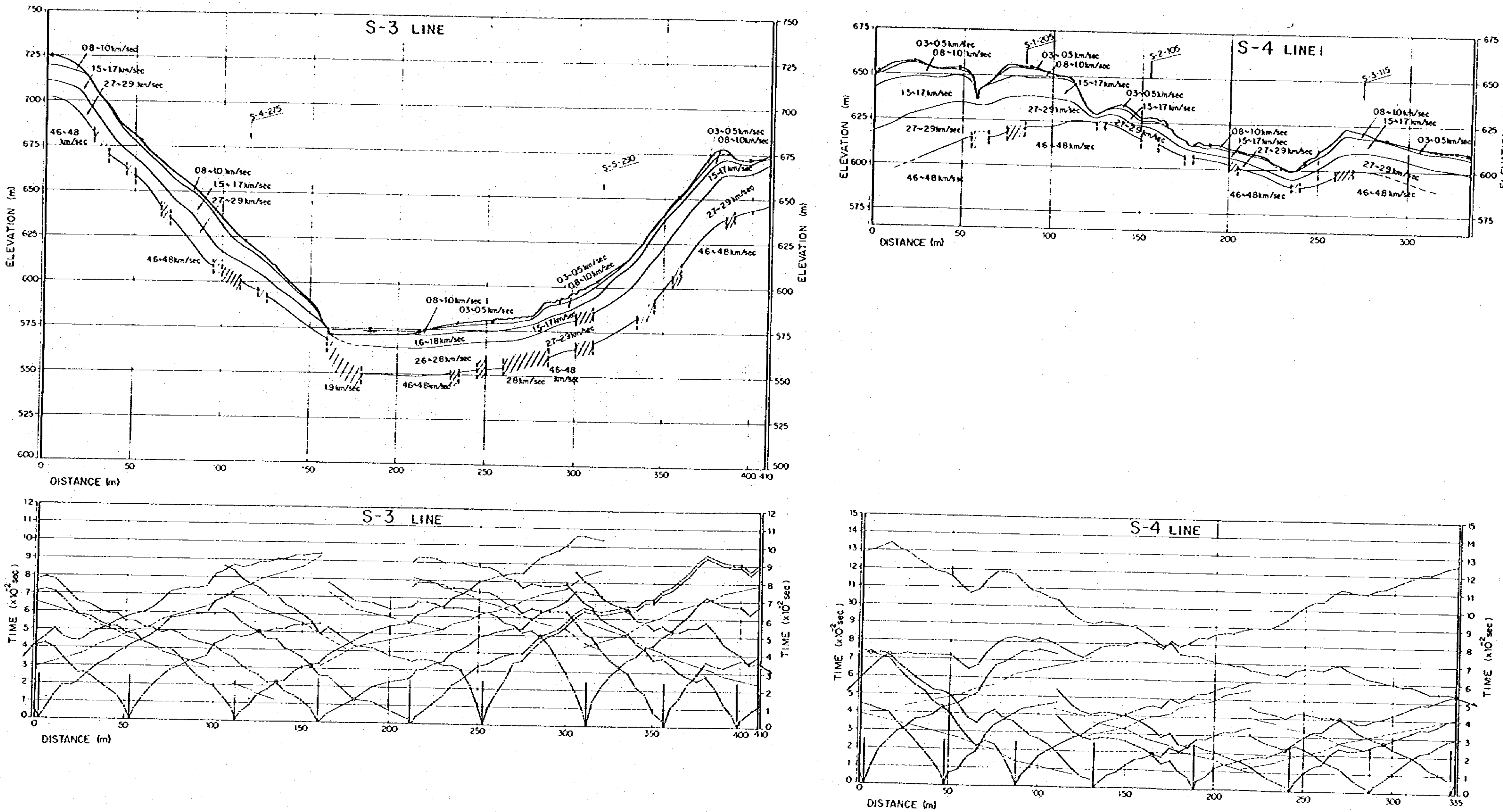


FIG. 3-19 CROSS-SECTION BY SEISMIC SURVEY AT SU.3 SITE

(2 of 3)

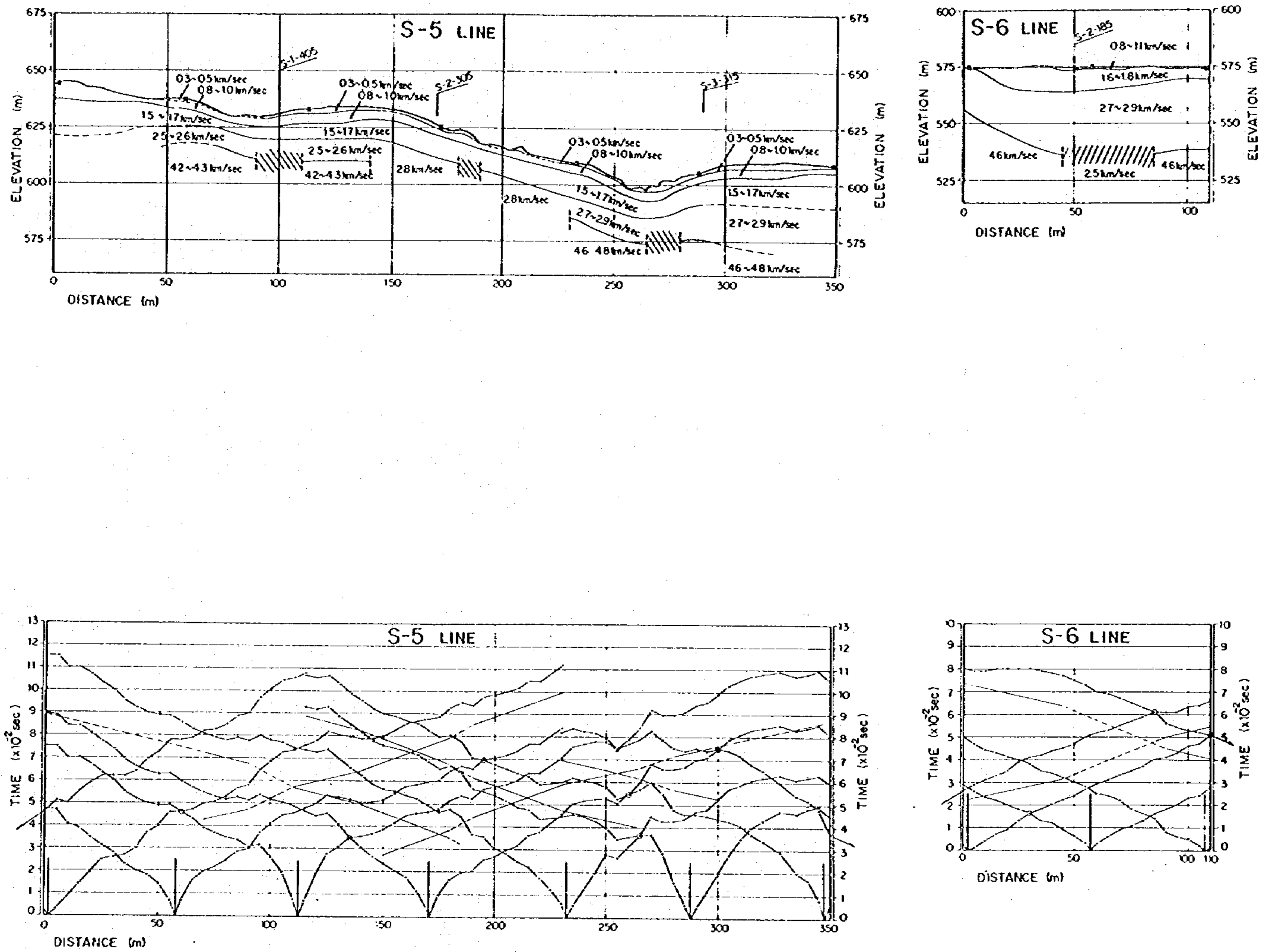


FIG. 3-19 CROSS-SECTION BY SEISMIC SURVEY AT SU.3 SITE
(3 of 3)

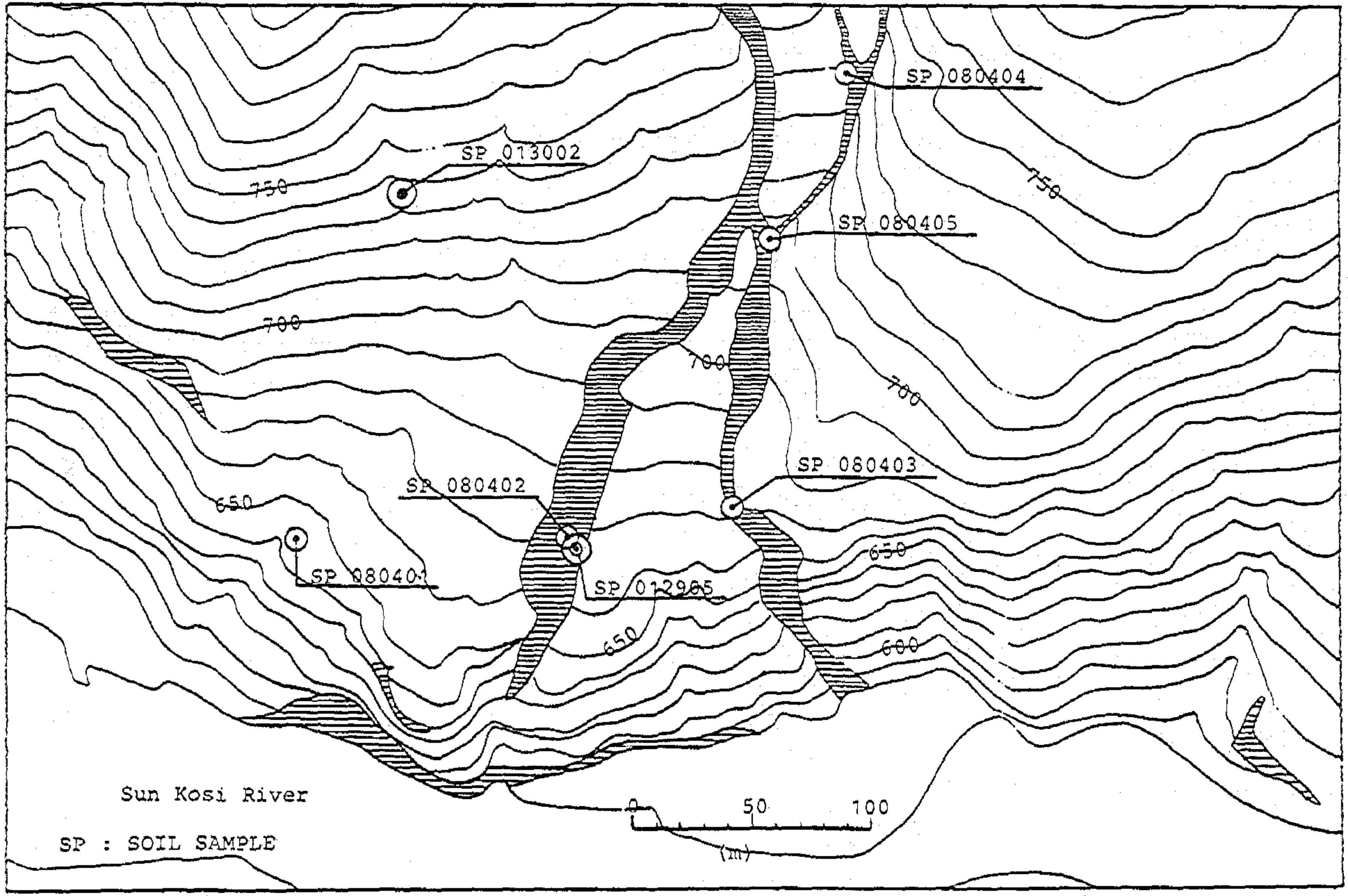


FIG. 3-20 **SOIL SAMPLING MAP AT SU.3 SITE**

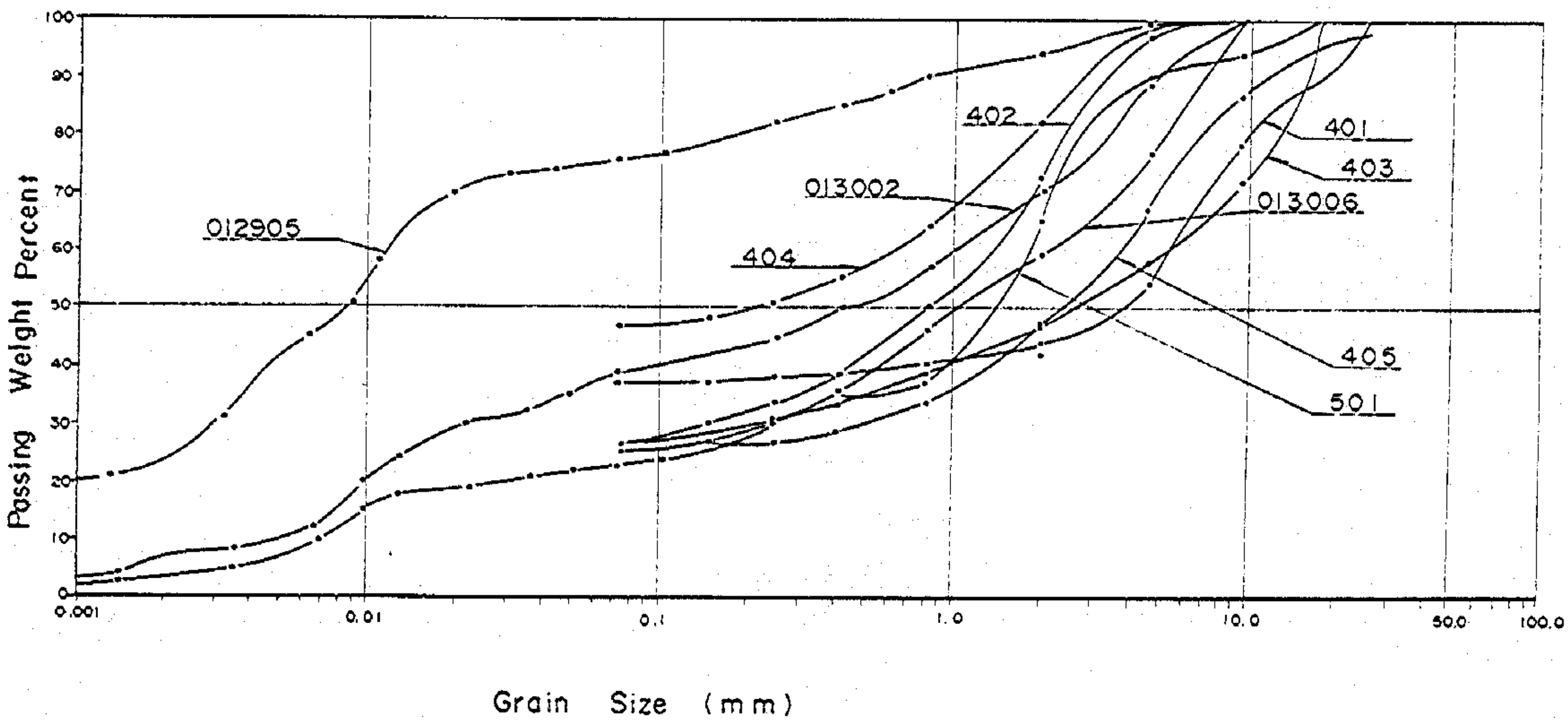


FIG. 3-21 **APTITUDES OF SOIL GRADING TEST AT SU.3 SITE**

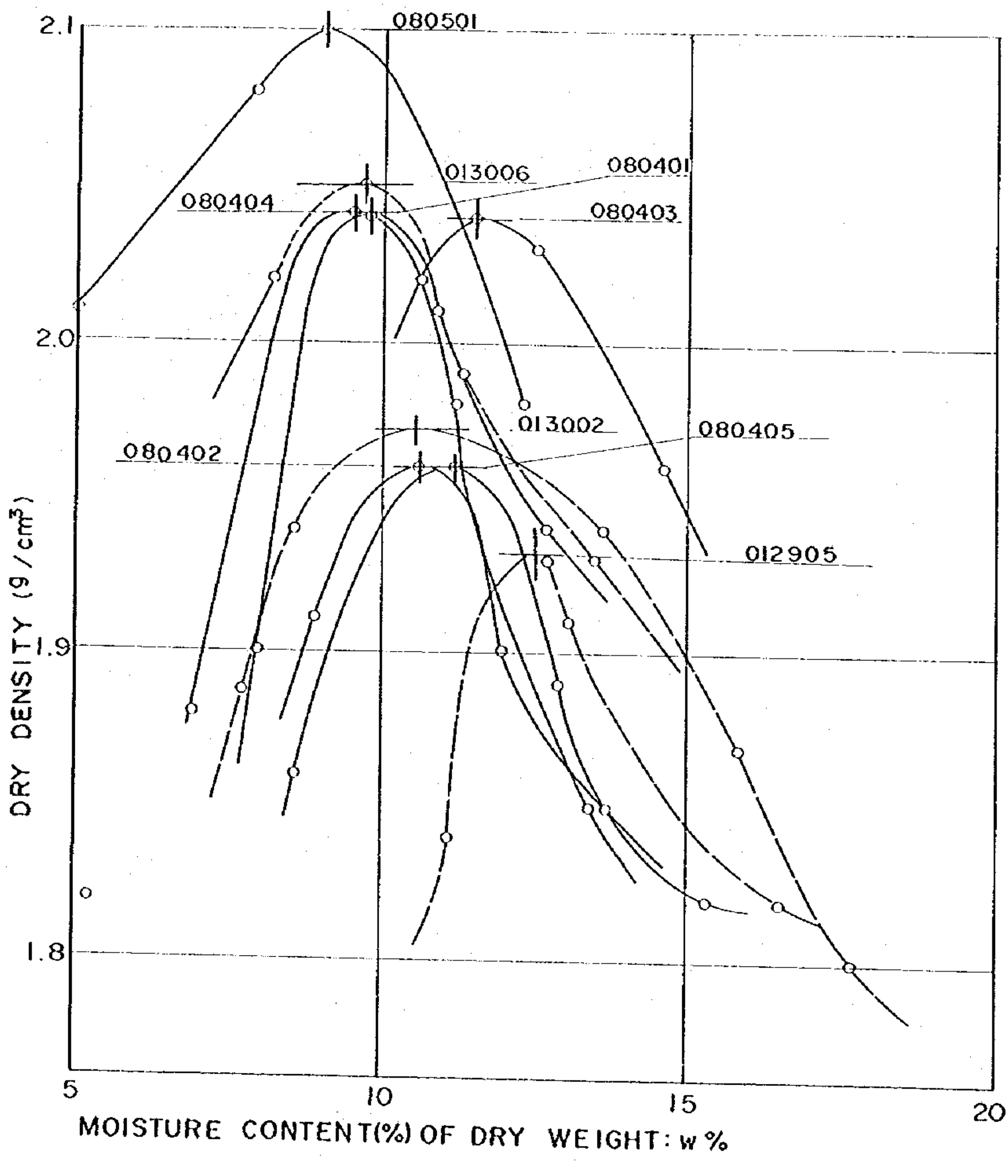


FIG. 3-22 **COMPACTION CURVES**

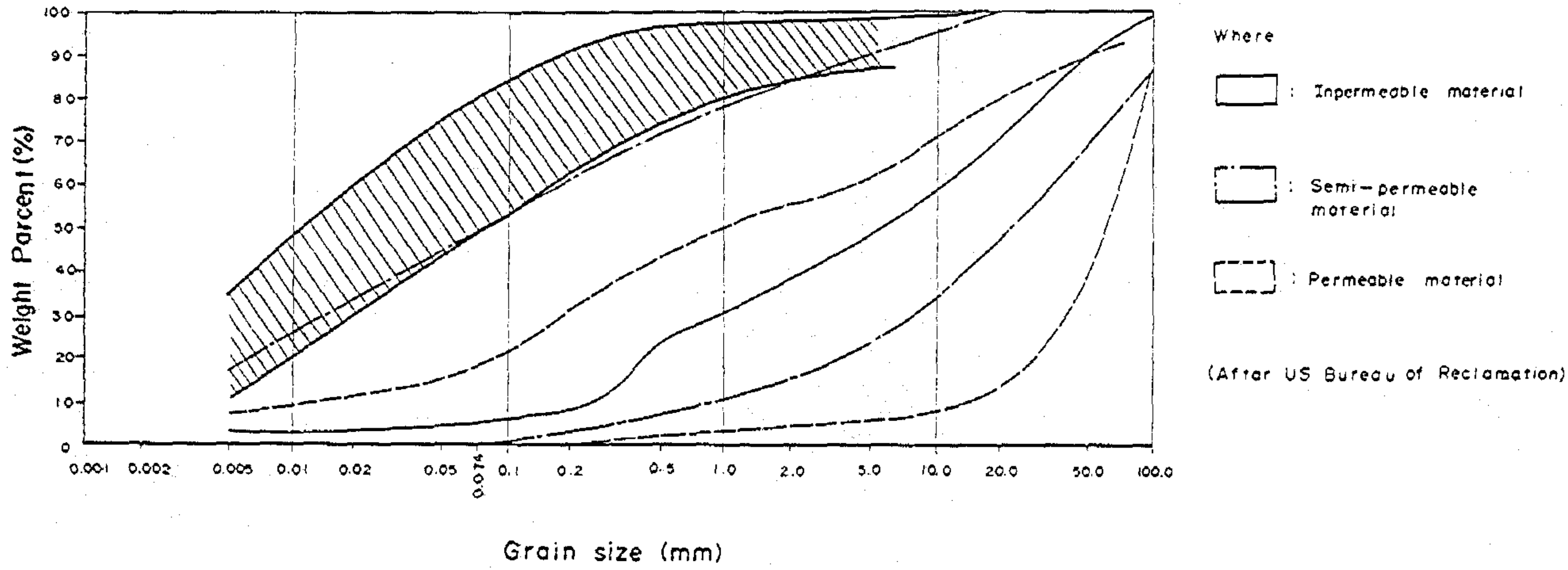


FIG. 3-23 APTITUDES OF MATERIALS FOR DAM BODY

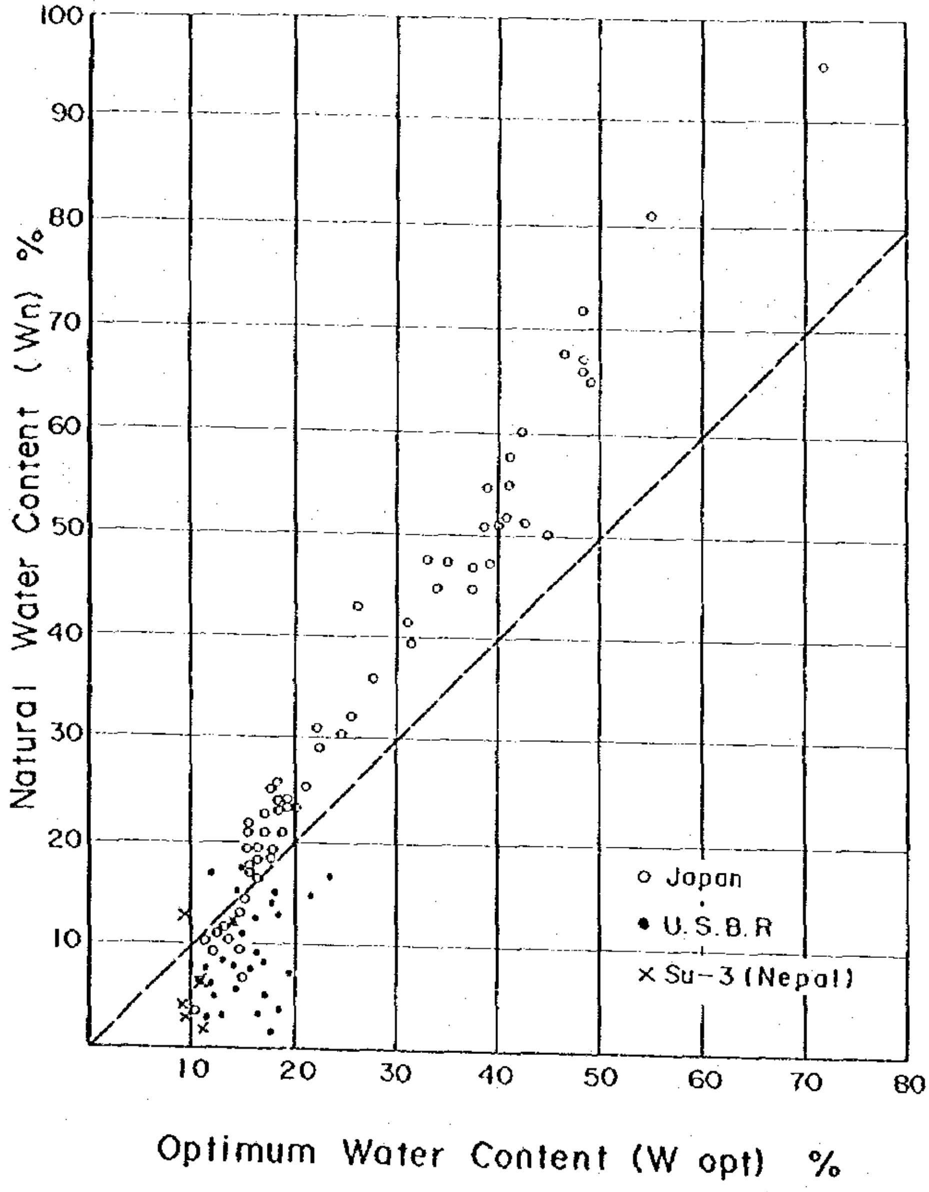


FIG. 3-24 **RELATION OF SOIL MATERIALS BETWEEN WN. - WOPT.**

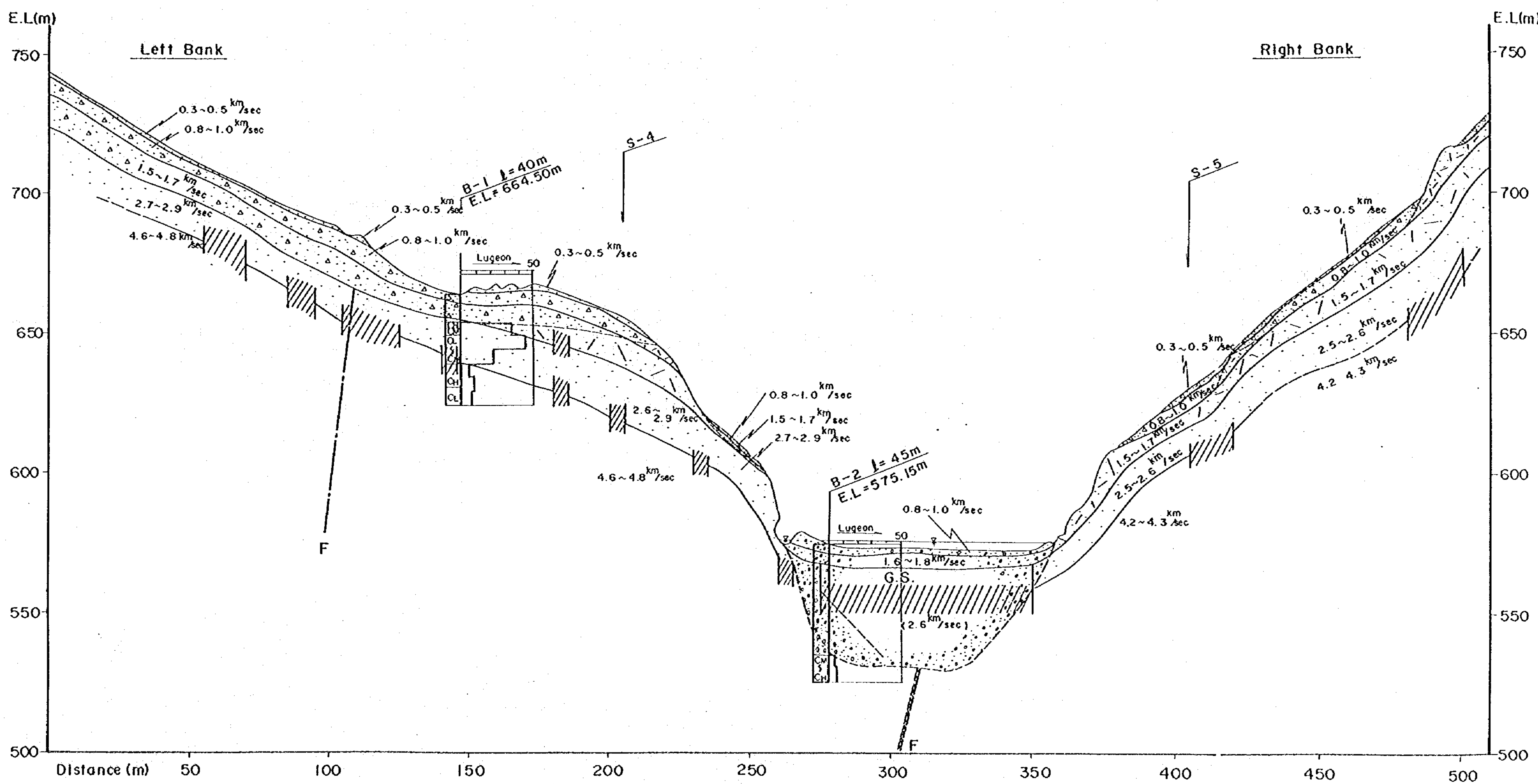
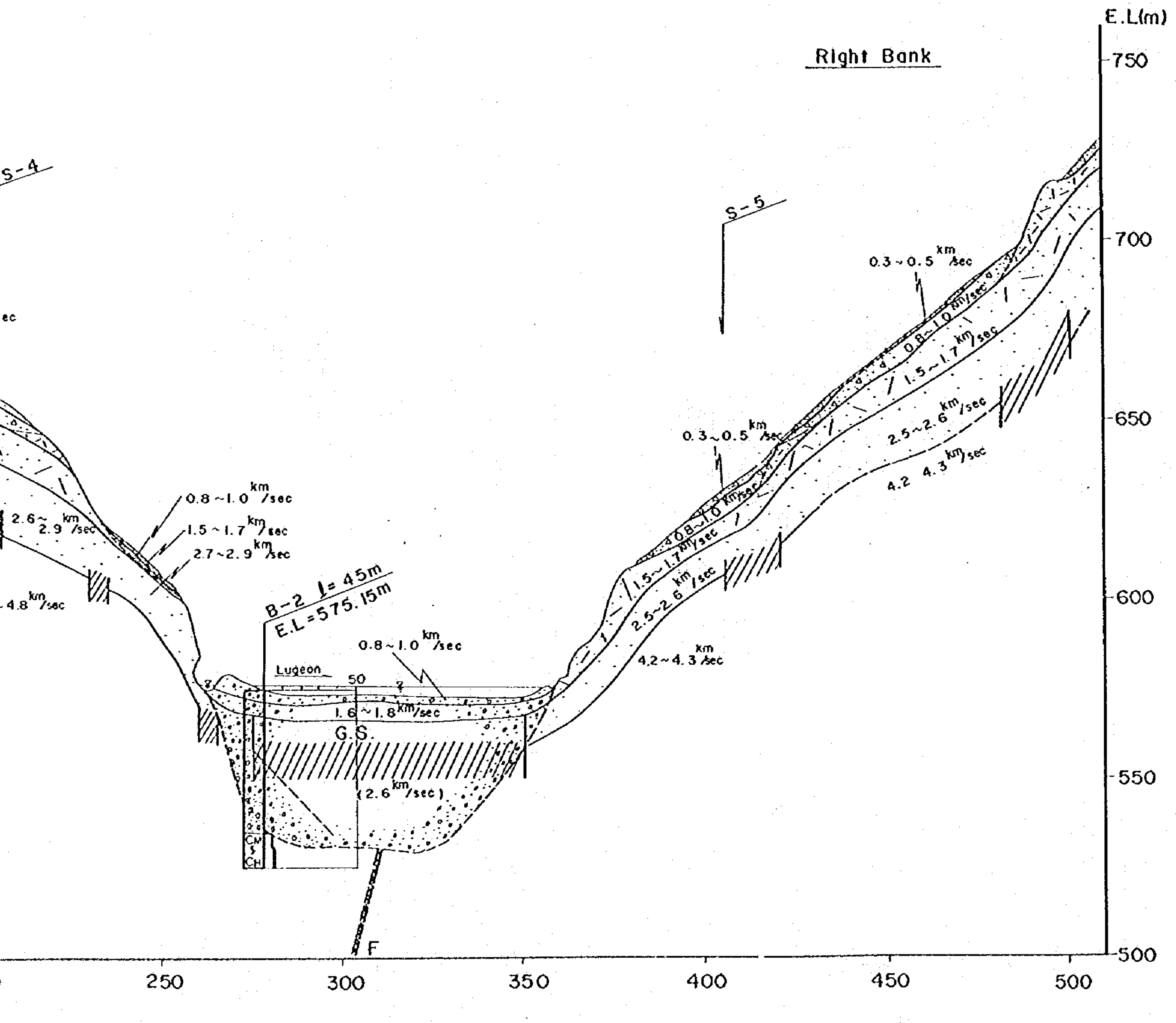


FIG. 3-25 GEOLOGICAL SECTIONAL DIAGRAM ALONG SU.3 DAM AXIS



H ALONG SU.3 DAM AXIS

Index

- Talus deposits (Dt)
- Gravels Sands River Deposits (G.S)

} Quaternary

- Upper weathering zone (W-1)
- Middle weathering zone (W-2)
- Lower weathering zone (W-3)
- Low velocity layer in Fresh Layer

} Upper Precambrian: Lower Nawakot G.
Kuncha F. : Phyllite, phyllitic sandstone

Estimable geological conditions of seismic velocity layer

Velocity layer	Seismic velocity	Corresponding with geology
1st	0.3~0.5 km/sec	Top soil and Talus
2nd	0.8~1.2 km/sec	Talus and Gravels and Sand and/or Upper weathering zone (W-1)
3rd	1.5~1.8 km/sec	Little cousolidated Gravels and Sands and/or Middle weathering zone (W-2)
4th	2.5~2.6 km/sec 2.7~2.9 /sec	Well cousolidated Gravels and Sands and/or Lower weathering zone (W-3)
5th	4.2~4.3 km/sec 4.6~4.8	Basement Rock (Fresh Layer)
		Low velocity layer and/or sheared zone

Examples of Quality Classifications of Rock in Dam Foundations

(1)

Classification	Characteristics
A	Rock-forming minerals[1] are fresh and not weathered or altered. Joints and cracks are very closely adhered with no weathering along their planes. A clear sound is emitted when hammered.
B	Rock-forming minerals are weathered slightly or partially altered, the rock being hard. Joints and cracks are closely adhered. A clear sound is emitted when hammered.
C_H	Rock-forming minerals are weathered but the rock is fairly hard. The bond between rock blocks is slightly reduced and each block is apt to be exfoliated along joints and cracks by strong hammering. Joints and cracks sometimes contain clay and other material which may be coloured by limonite. A slightly dull sound is emitted when hammered.
C_M	Rock-forming minerals are weathered and the rock is slightly soft. Exfoliation of the rock occurs along joints and cracks by normal hammering. Joints and cracks sometimes contain clay and other material. A somewhat dull sound is emitted when hammered.
C_L	Rock-forming minerals are weathered and the rock is soft. Exfoliation of the rock occurs along joints and cracks by light hammering. Joints and cracks contain clay. A dull sound is emitted when hammered.
D	Rock-forming minerals are weathered, and rock is very soft. There is virtually no bond between rock blocks, and collapse occurs at the slightest hammering. Joints and cracks contain clay. A very dull sound is emitted when hammered.

(1): Except quartz

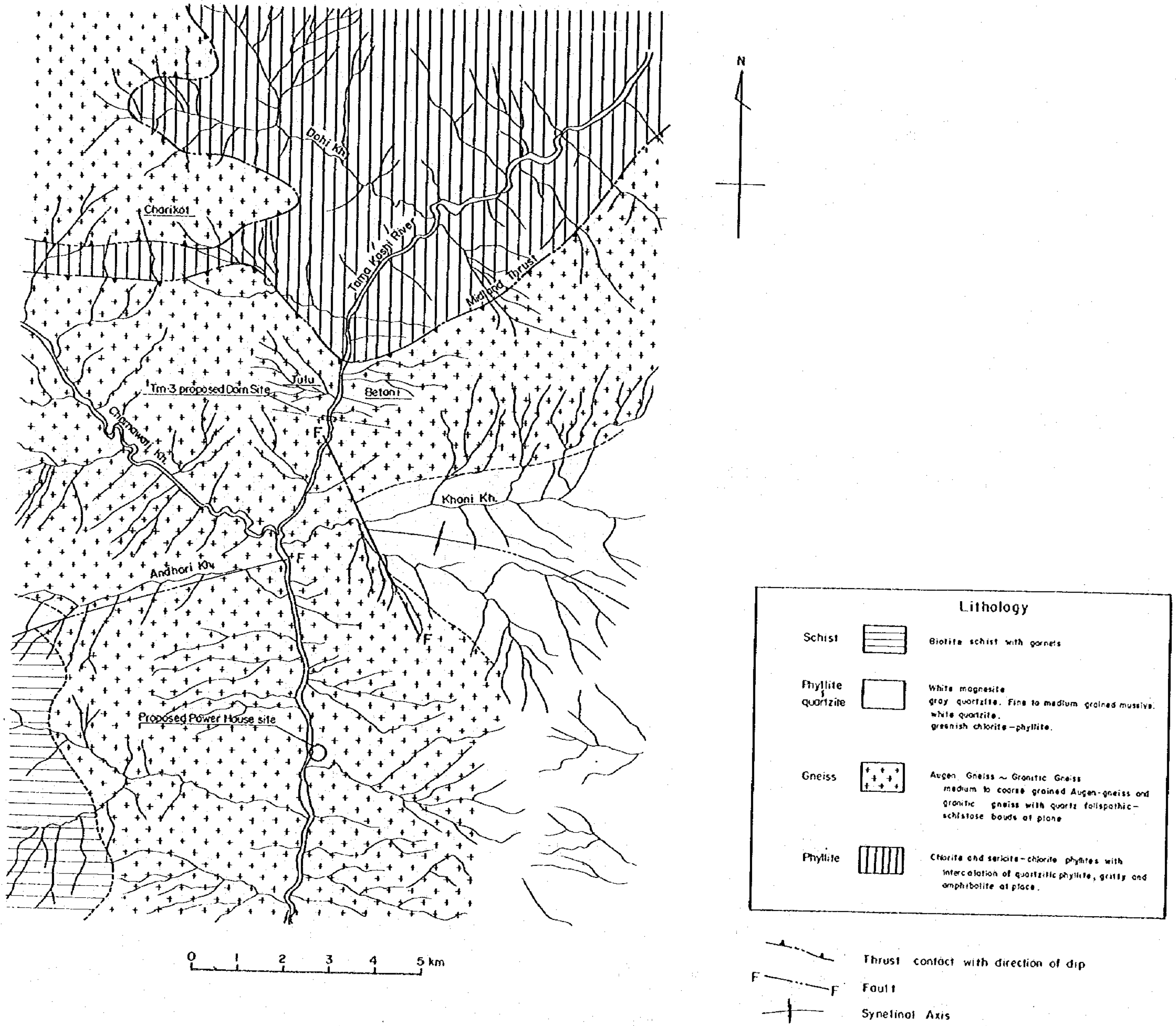


FIG. 3-26 **GEOLOGICAL MAP OF TAMA KOSI NO. 3 SITE**

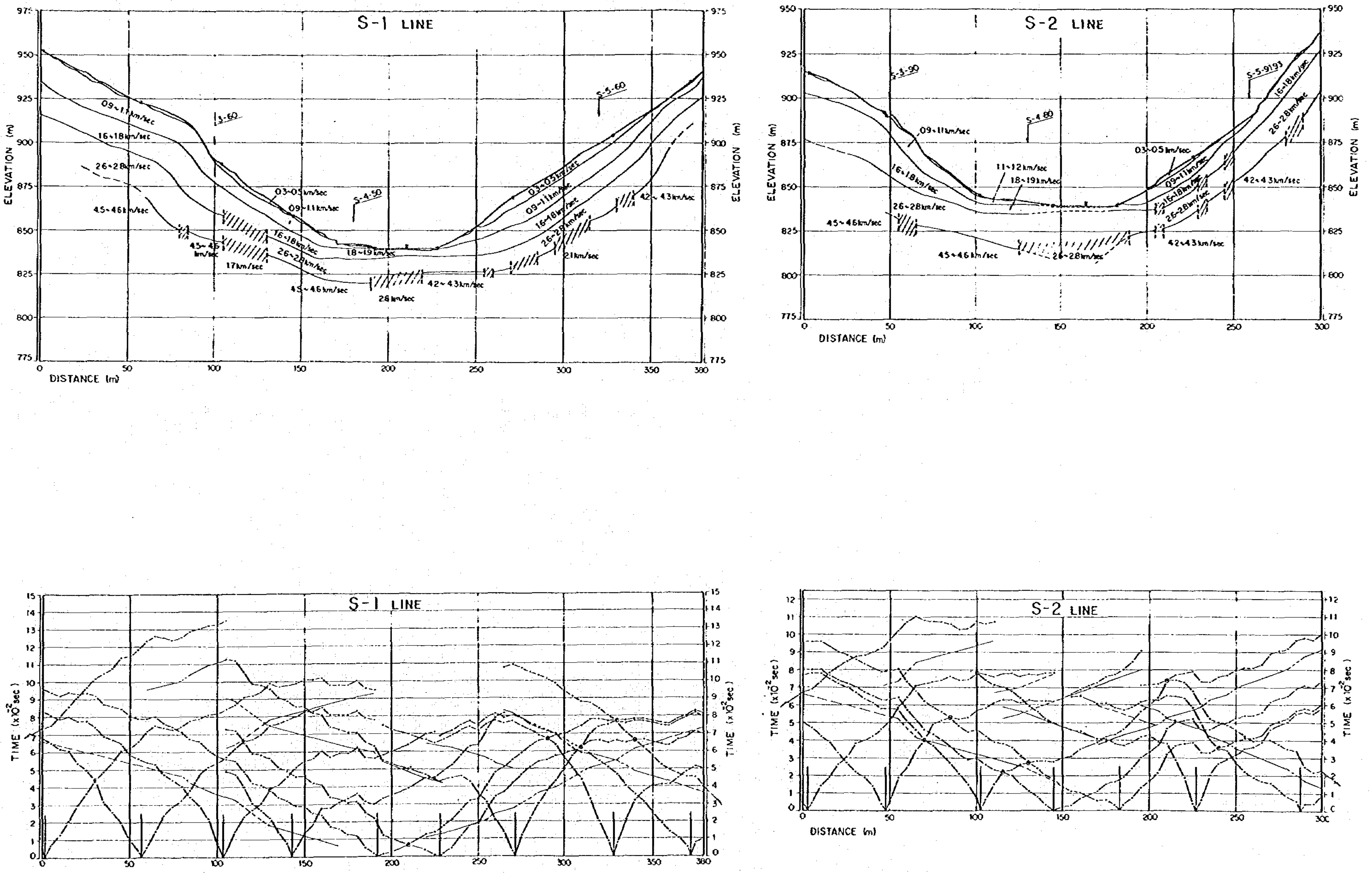


FIG. 3-27 CROSS-SECTIONS BY SEIHIC SURVEY AT TH 3 SITE

(1 of 3)

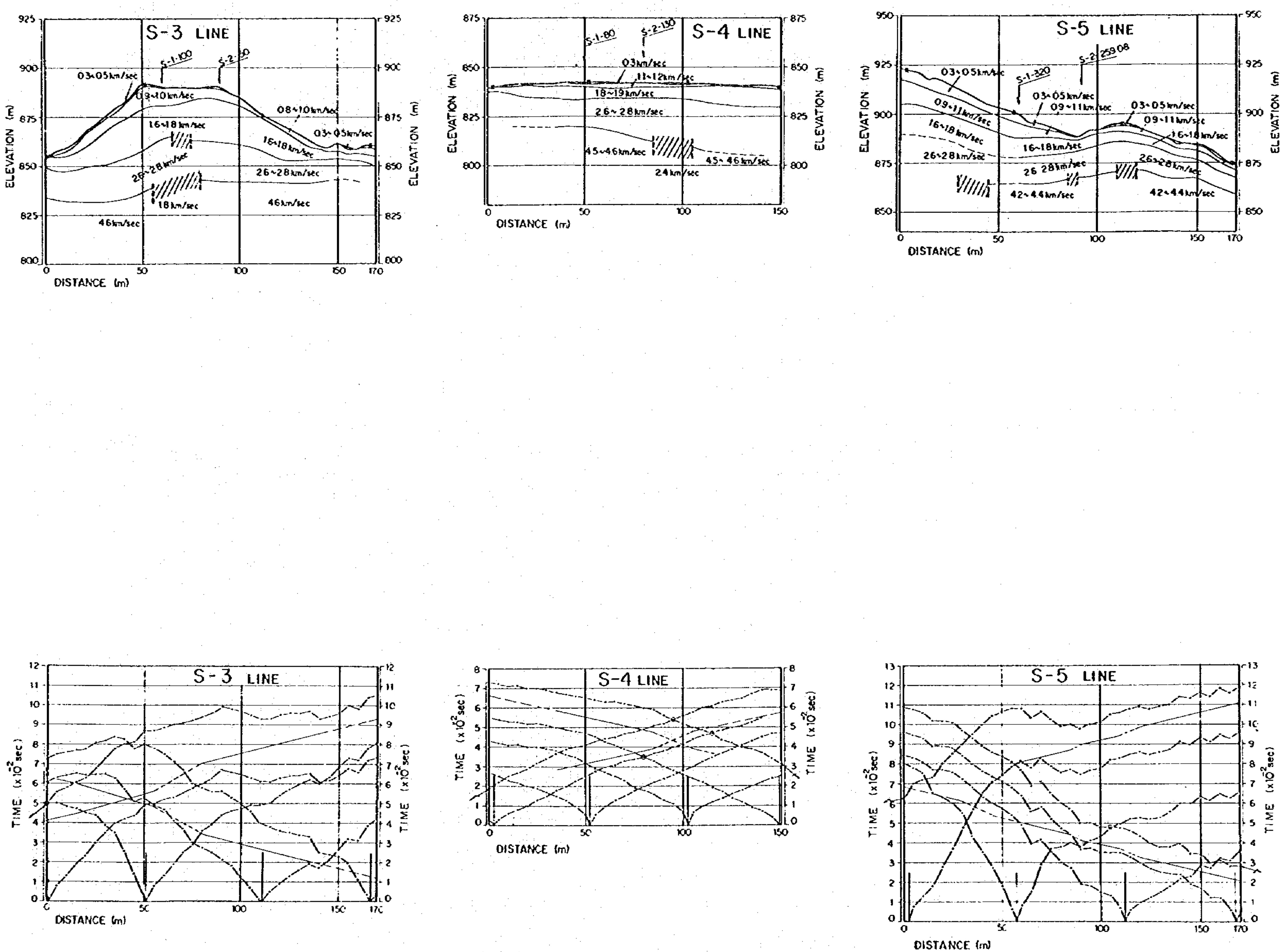


FIG. 3-27 CROSS-SECTIONS BY SEIMIC SURVEY AT TM 3 SITE

(2 of 3)

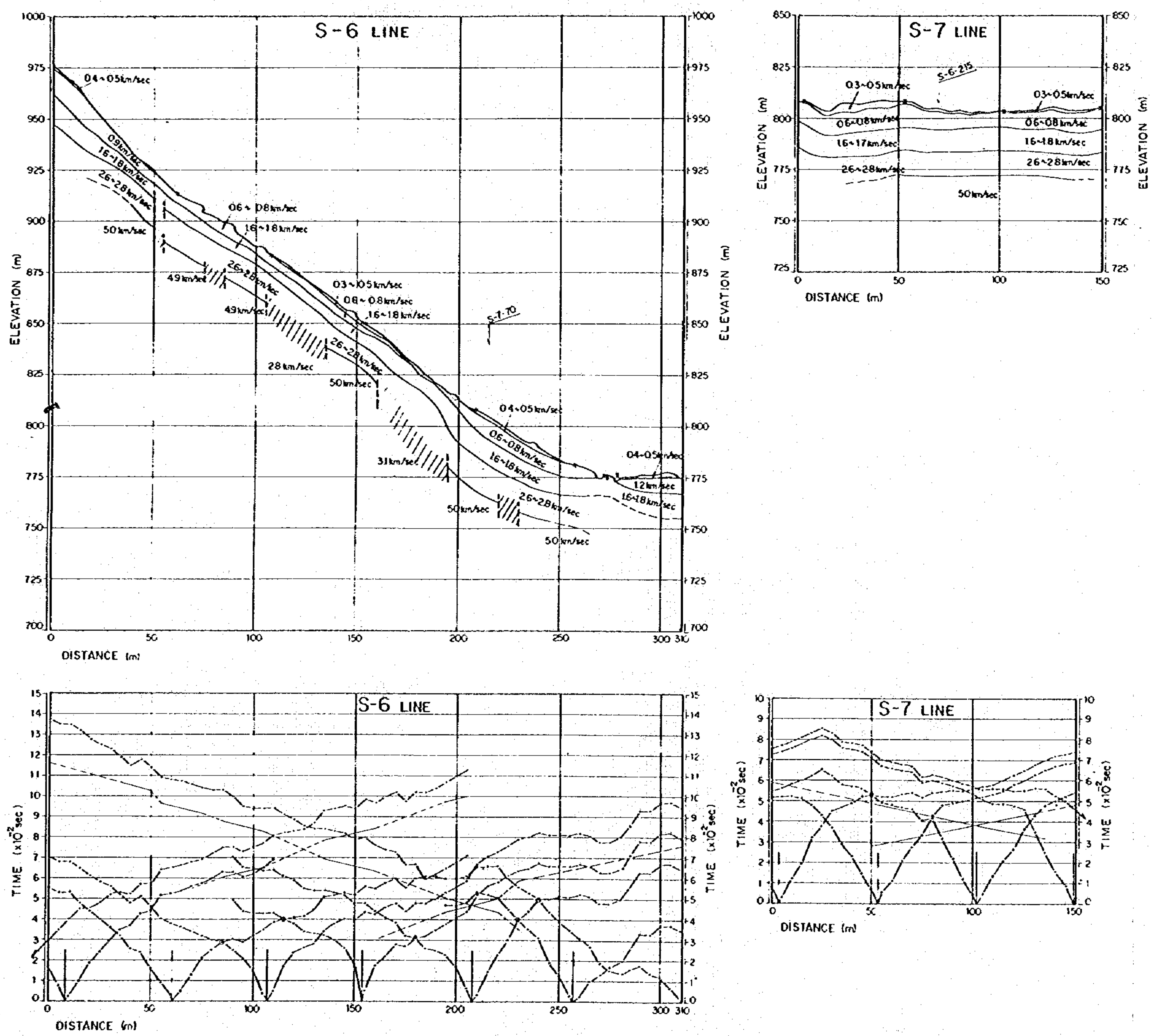


FIG. 3-27 CROSS-SECTIONS BY SEIMIC SURVEY AT TM 3 SITE

(3 of 3)

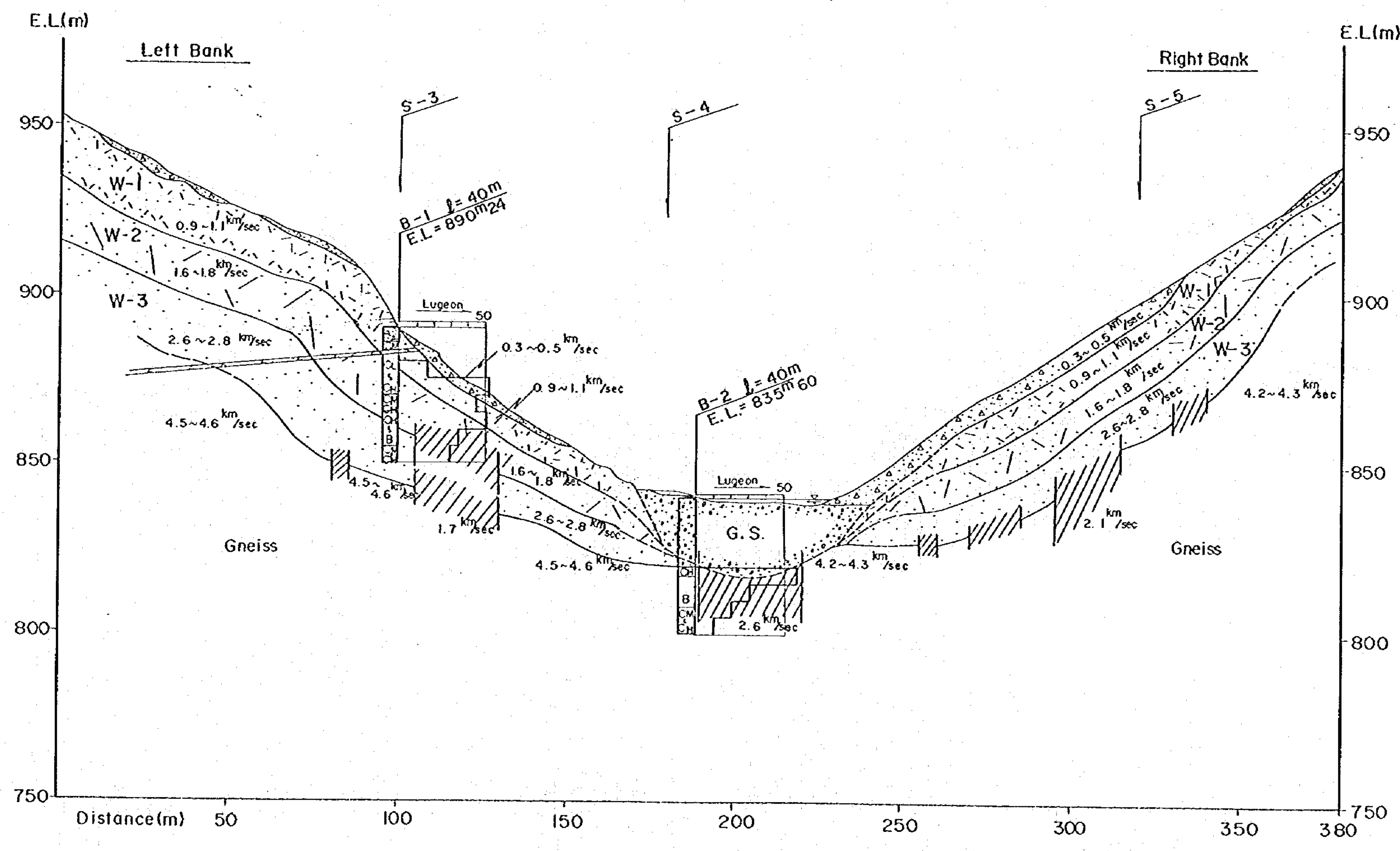


FIG. 3-29 GEOLOGICAL SECTION ALONG TA 3 DAM AXIS

Index

- Talus deposits (Dt)
- Gravels Sands River Deposits (G.S)
- Upper weathering zone (W-1)
- Middle weathering zone (W-2)
- Lower weathering zone (W-3)
- Low velocity layer in Fresh Layer

Estimable geological conditions of seismic

Velocity layer	Seismic velocity	Correspouding w
1st	0.3~0.5 km/sec	Top soil and To
2nd	0.8~1.1 km/sec 1.1~1.2	Talus and Grav Upper weatherin
3rd	1.6~1.8 km/sec 1.8~1.9	Little consolida and/or Middle w
4th	2.6~2.8 km/sec	Well consolidat and/or Lower w
5th	4.2~4.3 km/sec 4.5~4.6	Basement Rock
	(hatched)	Low velocity lay

Examples of Quality Classifications of

(1)

Classification	Chara
A	Rock-forming minerals(1) are fresh an cracks are very closely adhered with clear sound is emitted when hammere
B	Rock-forming minerals are weathered being hard. Joints and cracks are clo when hammered.
C_H	Rock-forming minerals are weathered between rock blocks is slightly reduc along joints and cracks by strong ham contain clay and other material whi slightly dull sound is emitted when ha
C_M	Rock-forming minerals are weathered tion of the rock occurs along joints a and cracks sometimes contain clay a sound is emitted when hammered.
C_L	Rock-forming minerals are weathered the rock occurs along joints and cra cracks contain clay. A dull sound is
D	Rock-forming minerals are weathered, no bond between rock blocks, and col ing. Joints and cracks contain clay hammered.

(1) : Except quartz

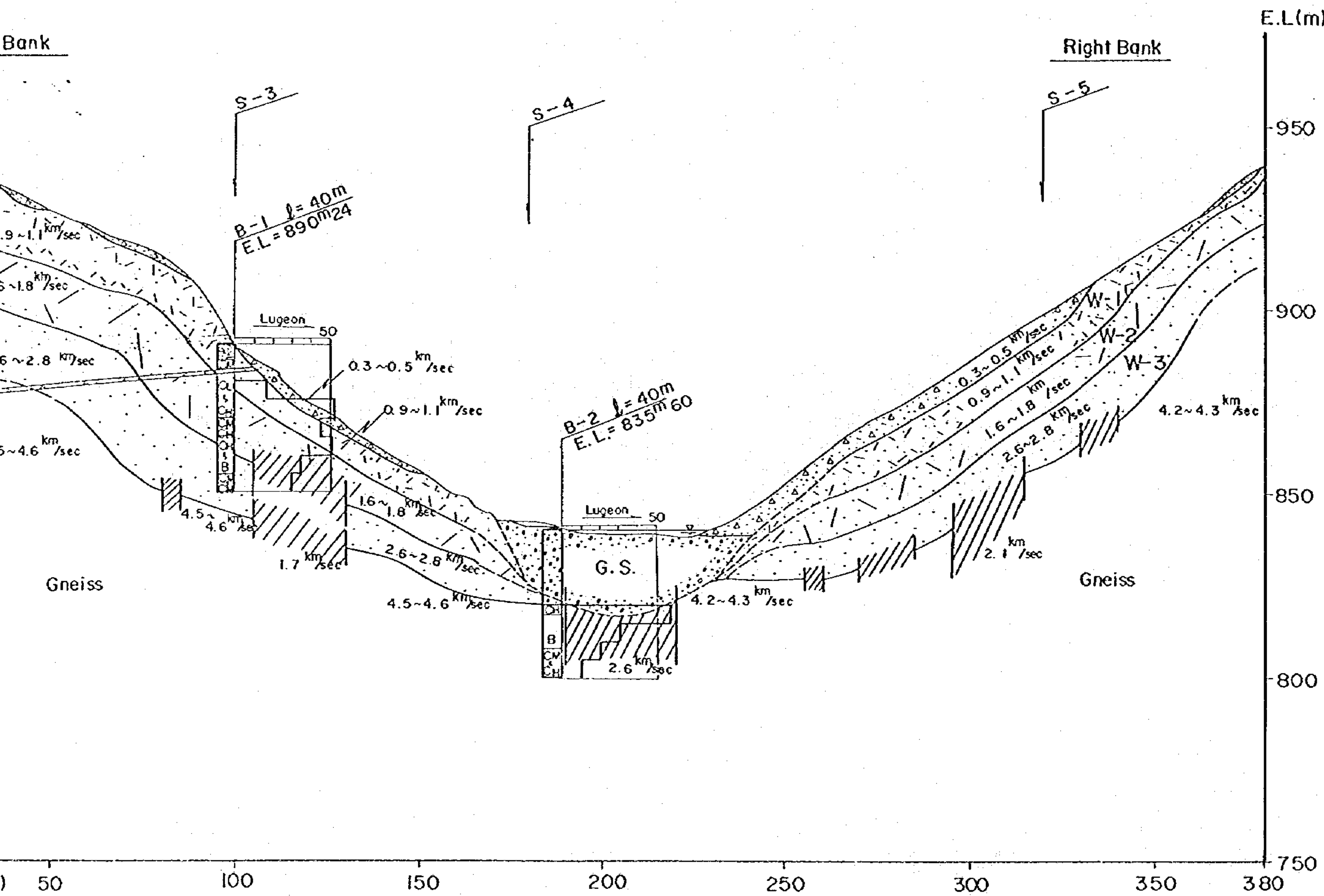


FIG. 3-29 GEOLOGICAL SECTION ALONG TA 3 DAM AXIS

Index

- Tolus deposits (Dt) } Quaternory
- Gravels Sands River Deposits (G.S) } Quaternory
- Upper weathering zone (W-1)
- Middle weathering zone (W-2)
- Lower weathering zone (W-3)
- Low velocity layer in Fresh Layer

(W-1 to Low velocity layer:) Precombrian Lower Suparitar F : Augen Gneiss Granitic-Gneiss With partly micaceous band

Estimable geological conditions of seismic velocity layer

Velocity layer	Seismic velocity	Correspouding with geology
1st	0.3~0.5 km/sec	Top soil and Tolus
2nd	0.8~1.1 km/sec 1.1~1.2	Tolus and Gravels and Sand and/or Upper weathering zone (W-1)
3rd	1.6~1.8 km/sec 1.8~1.9	Little consolidated Gravels and Sands and/or Middle weathering zone (W-2)
4th	2.6~2.8 km/sec	Well consolidated Gravels and Sands and/or Lower weathering zone (W-3)
5th	4.2~4.3 km/sec 4.5~4.6	Basement Rock (Fresh Layer)
	(hatched)	Low velocity layer and/or sheared zone

Examples of Quality Classifications of Rock in Dam Foundations

(1)

Classification	Characteristics
A	Rock-forming minerals(1) are fresh and not weathered or altered. Joints and cracks are very closely adhered with no weathering along their planes. A clear sound is emitted when hammered.
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C_M	Rock-forming minerals are weathered and the rock is slightly soft. Exfoliation of the rock occurs along joints and cracks by normal hammering. Joints and cracks sometimes contain clay and other material. A somewhat dull sound is emitted when hammered.
C_L	Rock-forming minerals are weathered and the rock is soft. Exfoliation of the rock occurs along joints and cracks by light hammering. Joints and cracks contain clay. A dull sound is emitted when hammered.
D	Rock-forming minerals are weathered, and rock is very soft. There is virtually no bond between rock blocks, and collapse occurs at the slightest hammering. Joints and cracks contain clay A very dull sound is emitted when hammered.

(1): Except quartz

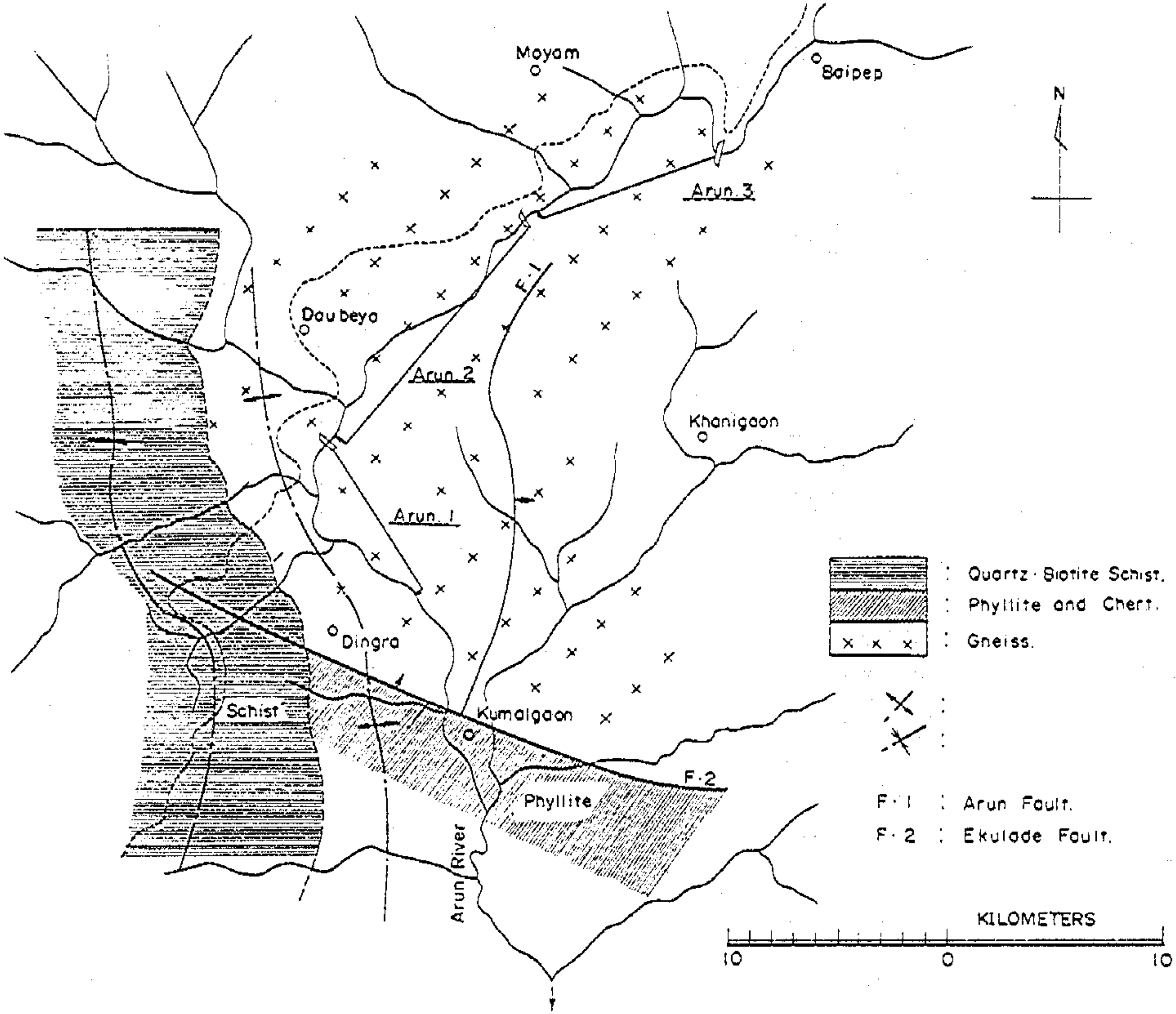


FIG. 3-30 **SCHEMATIC GEOLOGICAL MAP OF THE ARUN NO. 1 - 3 SITES**

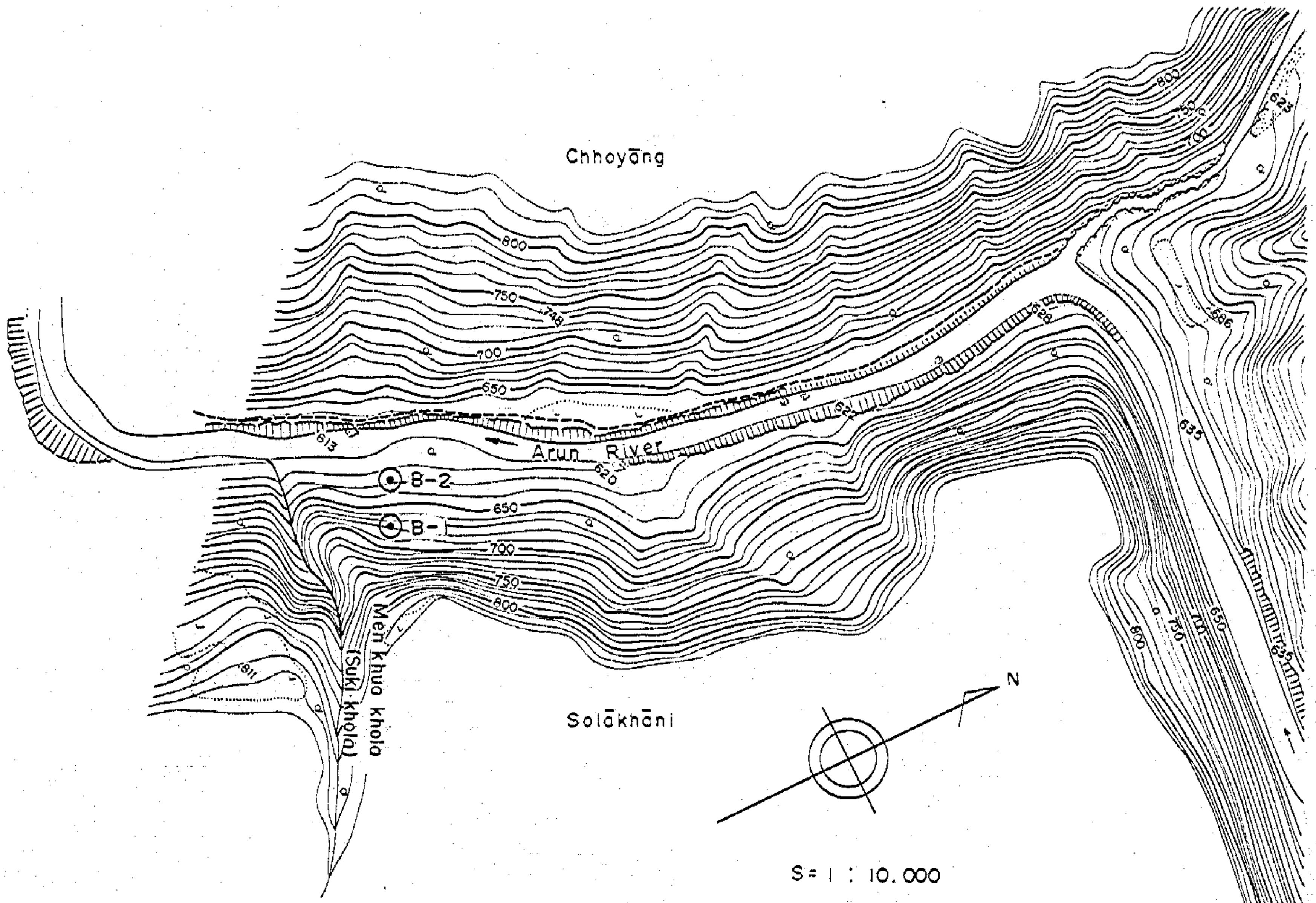
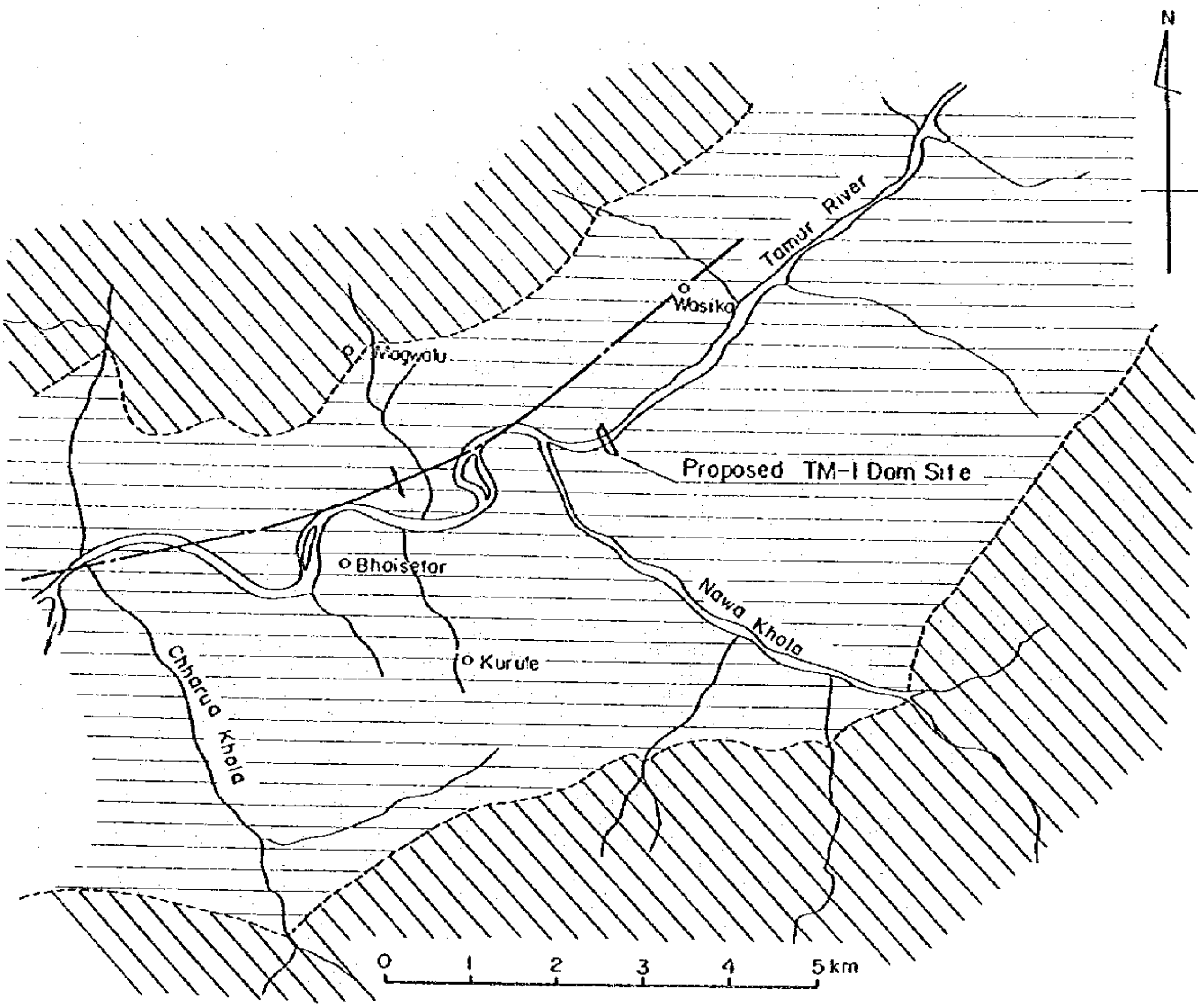


FIG. 3-31 Drilling Points at Penstock and Power House in AR. 3



Stratigraphy of Tamur NO.I Area

Possible age	Formation		Lithology
Cambrian	(diagonal hatching)	Dhankuta Schist	Quartz, Biotite, Muscovite, — Schist
Precambrian	(horizontal lines)	Telio Kholo F.	Phillite and Quartzite

Anticlinal AXis

FIG. 3-33 **GEOLOGICAL MAP OF TAMUR NO. 1 AREA**

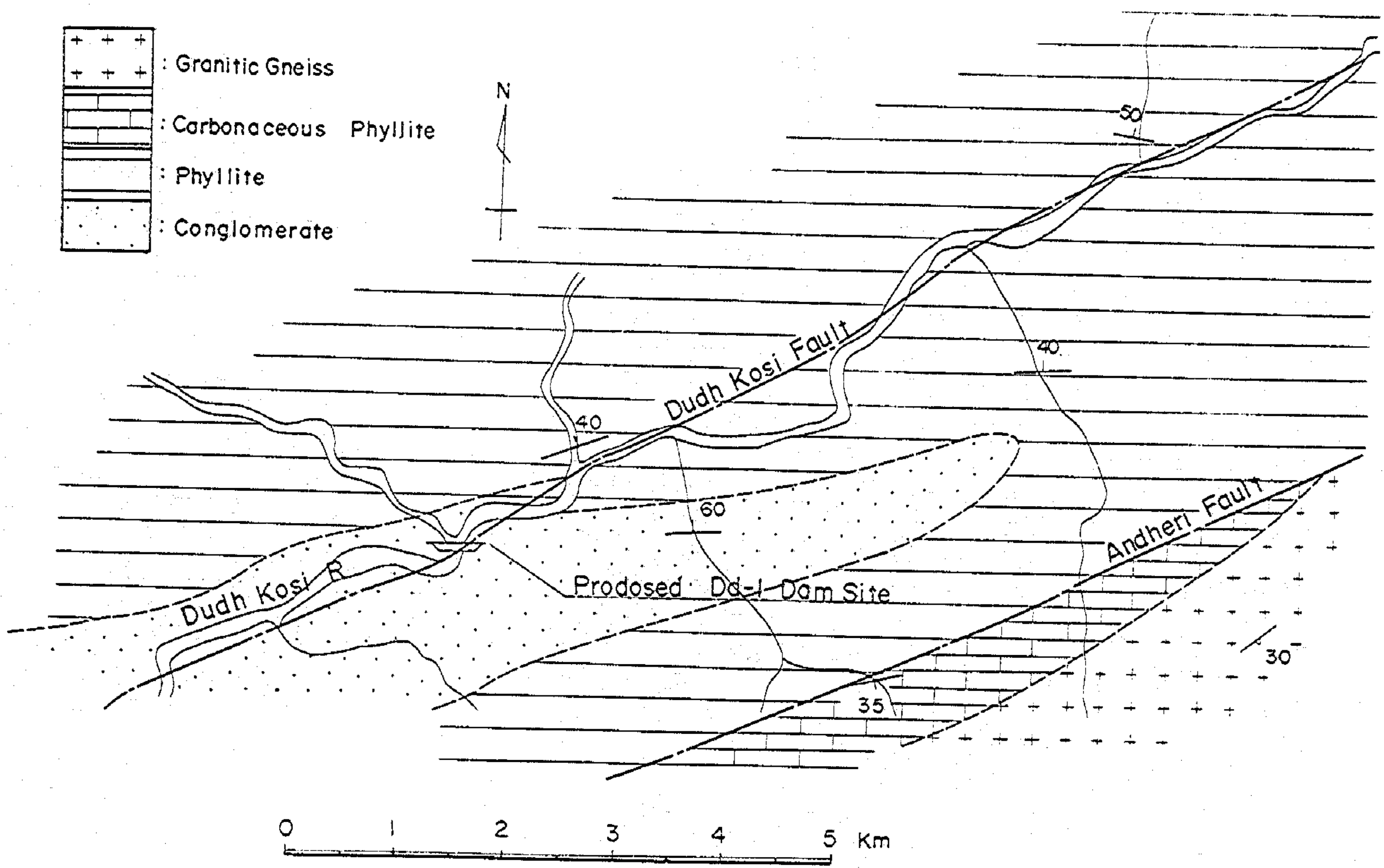


FIG. 3-34 **GEOLOGICAL MAP OF DUDH KOSI NO. 1 AREA**

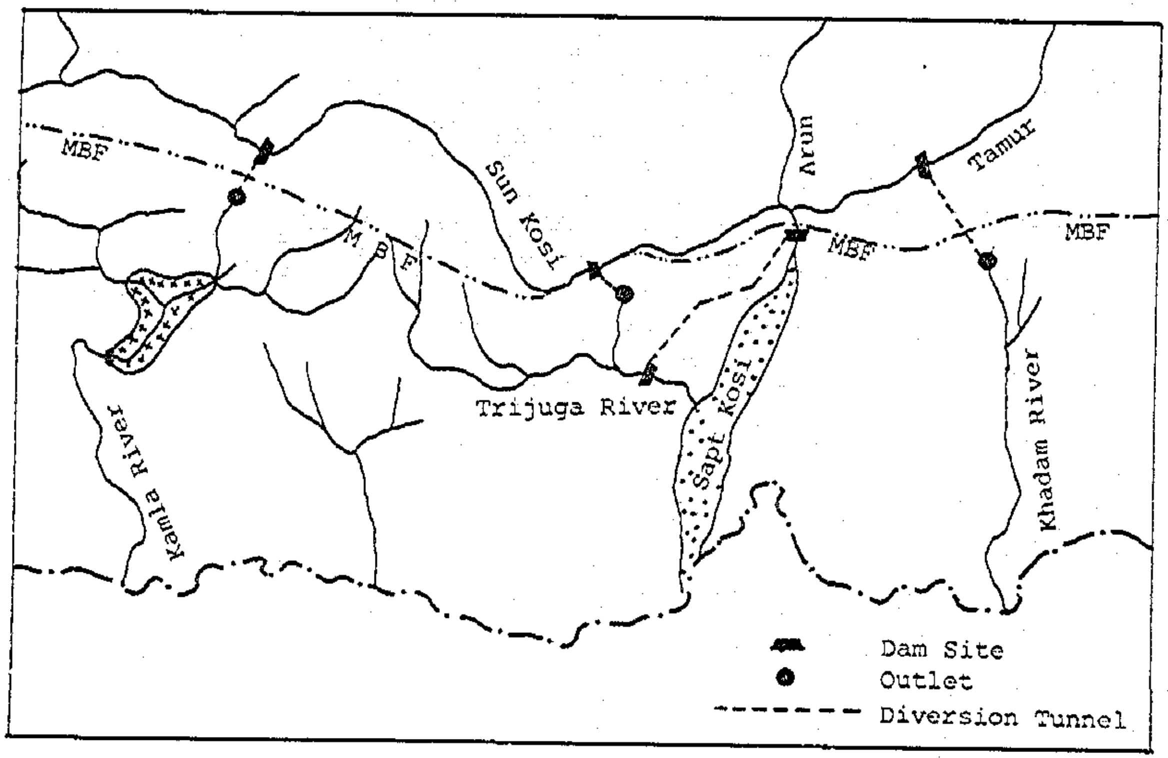


FIG. 3-35 **DISTRIBUTION OF THE MAIN BOUNDARY FAULT IN EASTERN NEPAL AND THE GEOLOGICAL SURVEY LOCATION**

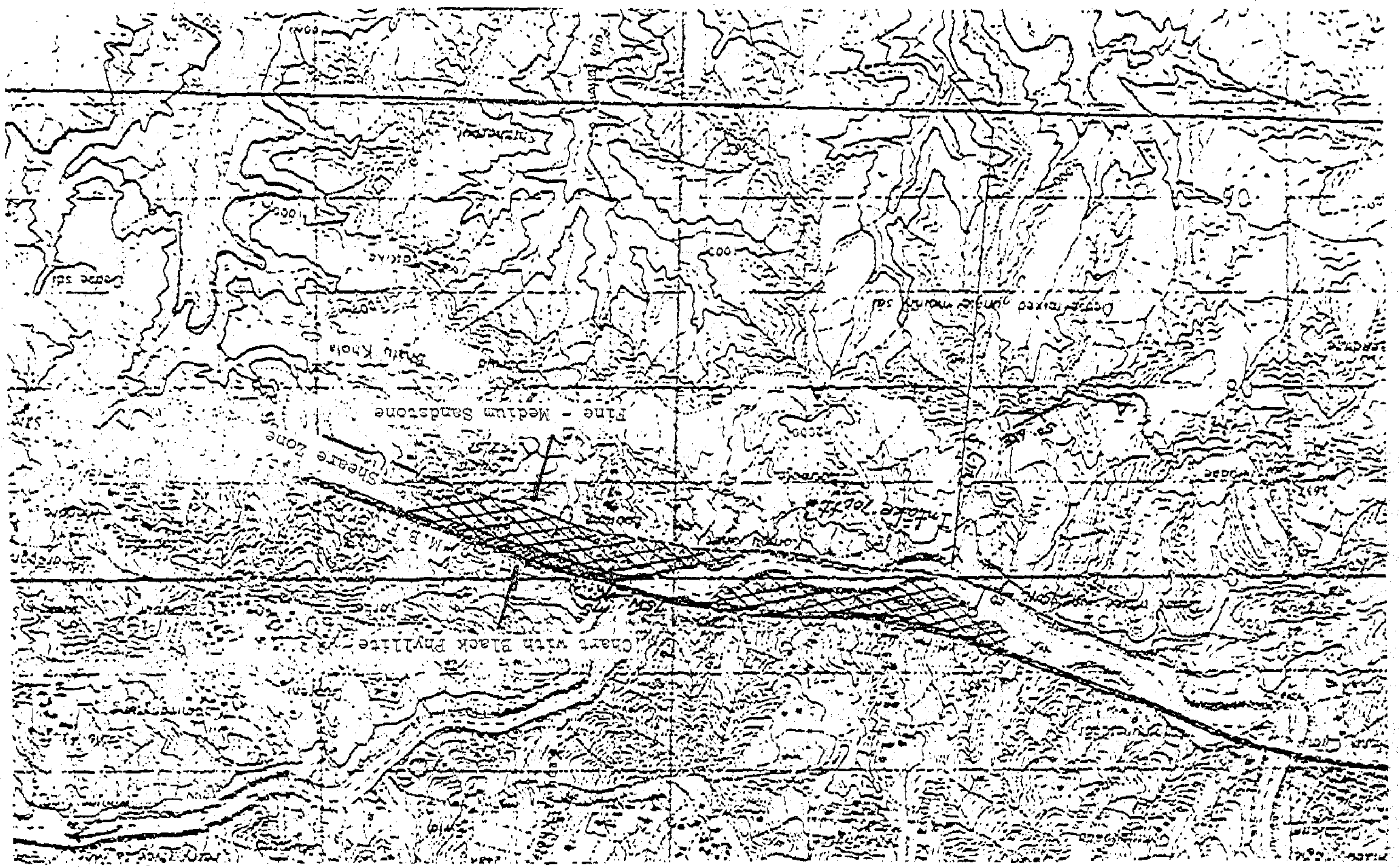


FIG. 3-36 GEOLOGICAL MAP OF LOCATION NO. 2

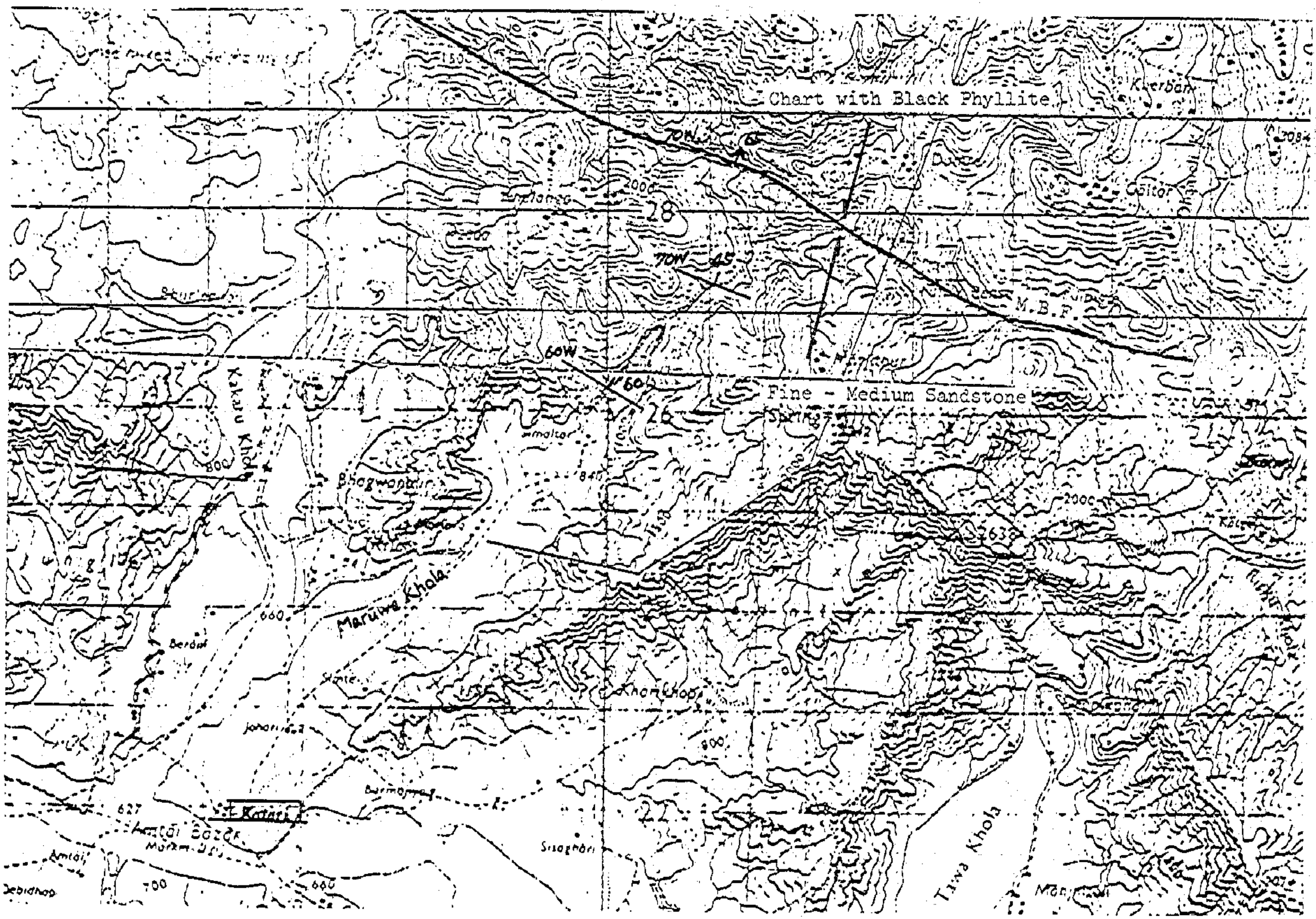


FIG. 3-37 GEOLOGICAL MAP OF LOCATION NO. 3

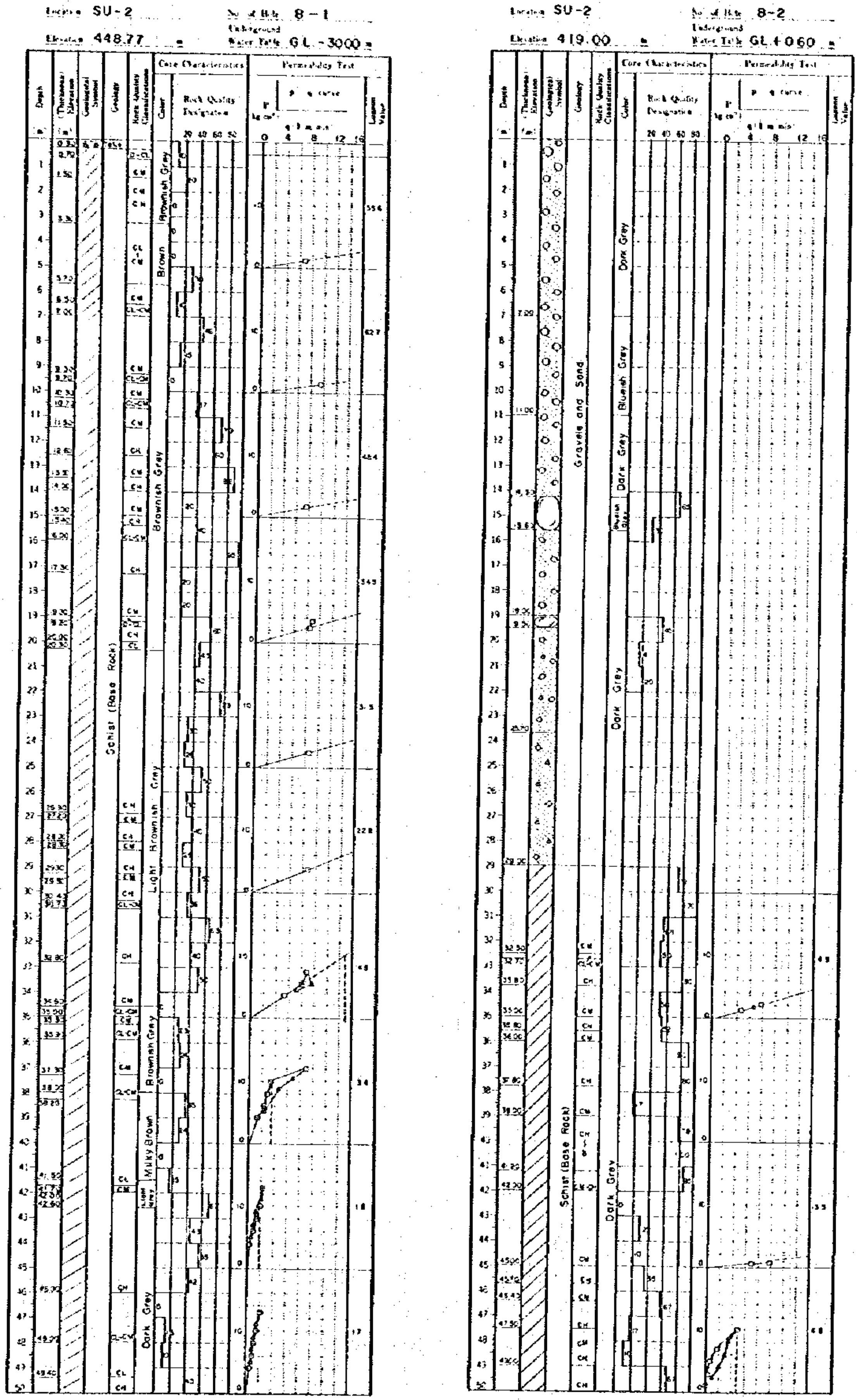


FIG. 3-39 DRILLING CORE LOG
1 of 5

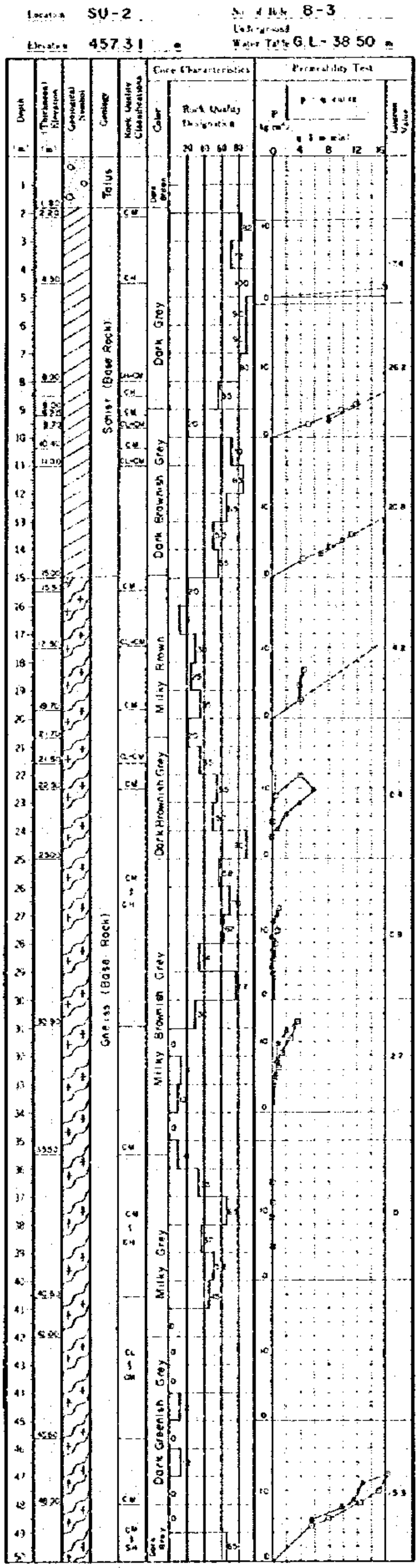
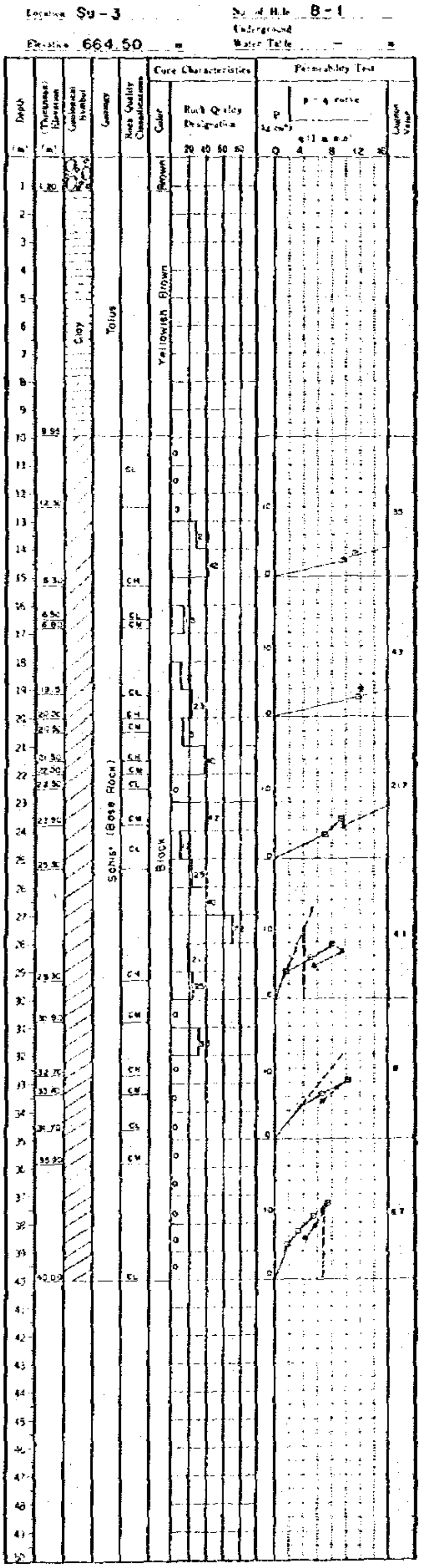


FIG. 3-39 DRILLING CORE LOG
2 0f 5



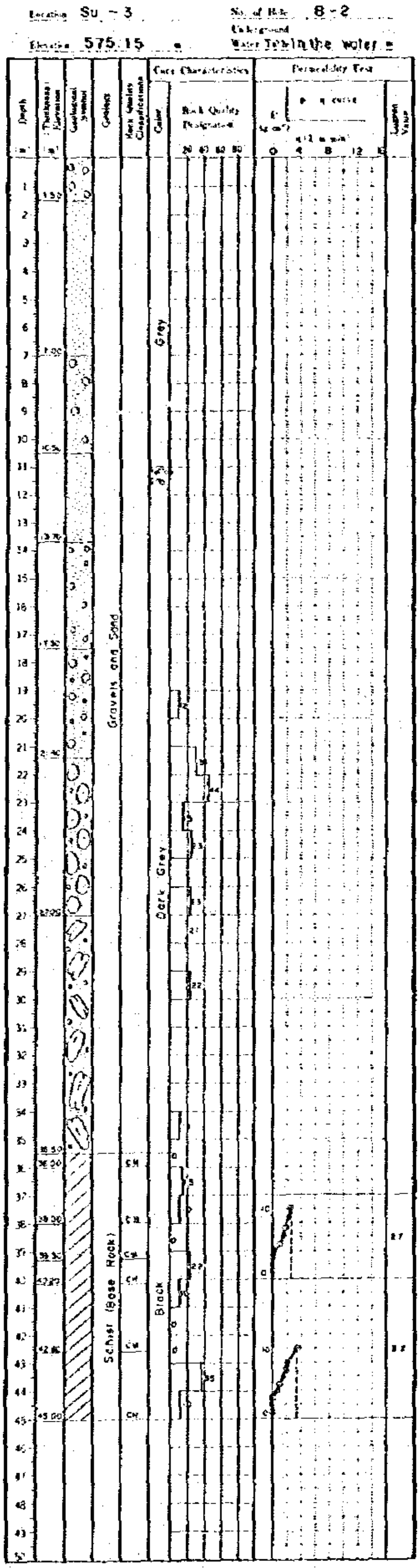
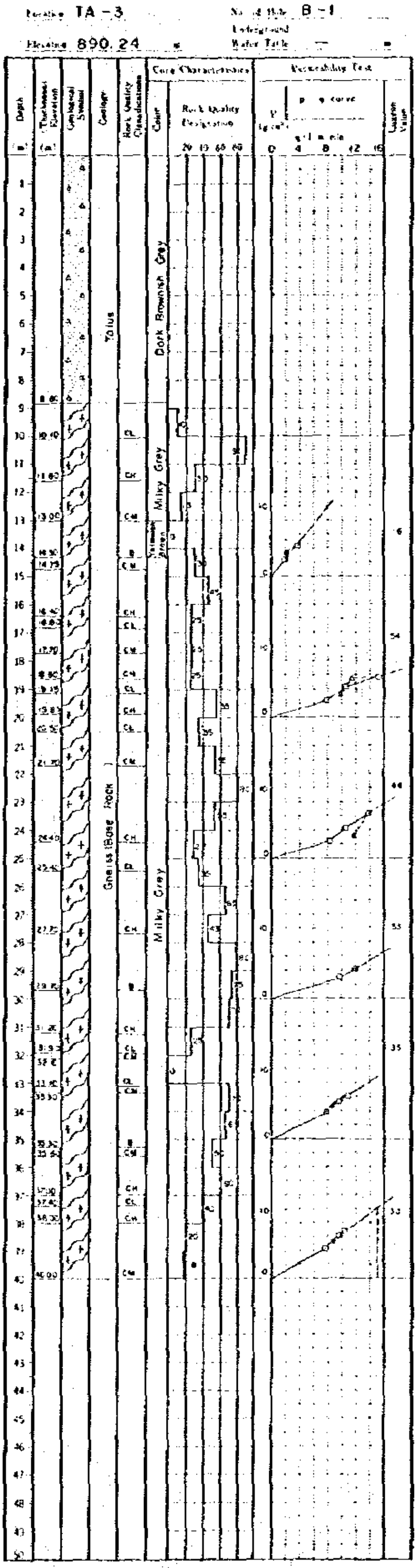


FIG. 3-39 DRILLING CORE LOG
3 of 5



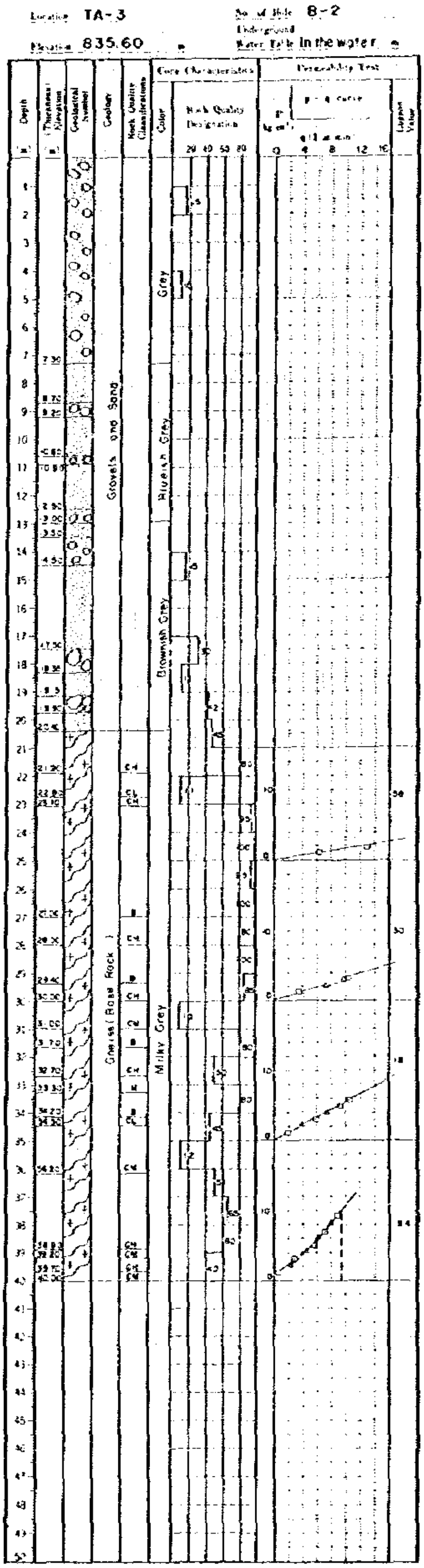


FIG. 3-39 DRILLING CORE LOG
4 of 5

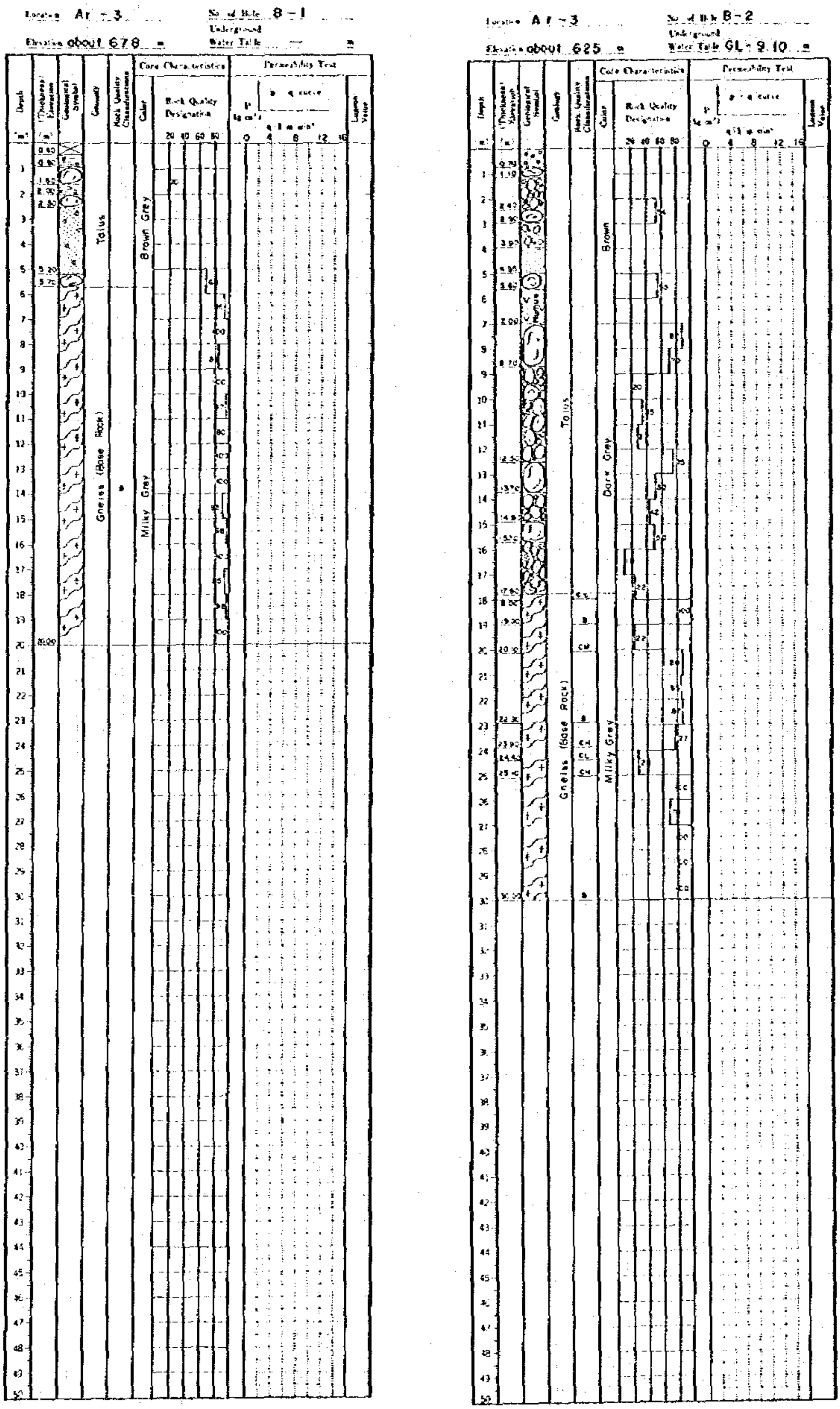


FIG. 3-39 DRILLING CORE LOG
5 of 5

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	- do -	- do -	72 E/C
	- do -	- do -	72 E/C
	1982	- do -	72 F/A
	- do -	- do -	72 F/B
	1984	- do -	72 I/C
	- do -	- do -	72 I/D
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	1982	Geological Map: Western Development Region	72 J/D
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	- do -	- do -	72 M/D
	- do -	- do -	72 N/A
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