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UNCLASSIFIED FN-TR-27-DM-VOL-2 NL

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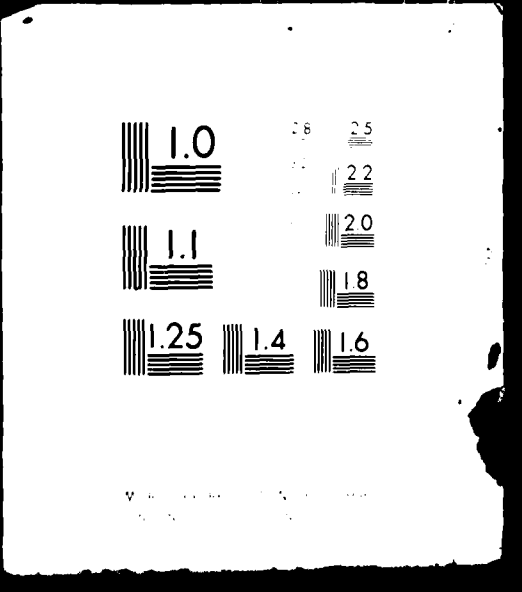

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GEOTECHNICAL EVALUATION

AD A113391

VERIFICATION STUDY
DELAMAR VALLEY, NEVADA
VOLUME II - GEOTECHNICAL DATA

PREPARED FOR
BALLISTIC MISSILE OFFICE (BMO)
NORTON AIR FORCE BASE, CALIFORNIA

FUGRO NATIONAL, INC.
Consulting Engineers and Geologists

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number): This report contains field data + lab test results from verification investigation of Delamar Valley. Includes borehole data, consisting of depth to rock, depth to water, seismic refraction survey, electrical resistivity survey, soil and trench logs, sieve analyses, and soil profiles.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

FN-TR-27-DM-II

MX SITING INVESTIGATION
GEOTECHNICAL EVALUATION

VERIFICATION STUDY - DELAMAR VALLEY
NEVADA

VOLUME II - GEOTECHNICAL DATA

Prepared for:

U.S. Department of the Air Force
Ballistic Missile Office (BMO)
Norton Air Force Base, California 92409

Prepared by:

Fugro National, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

24 March 1981

FOREWORD

This volume of geotechnical data was compiled for the Department of the Air Force, Ballistic Missile Office (BMO), in compliance with Contract No. F04704-80-C-0006, CDRL Item 004A6. It contains the field data and laboratory test results from the Verification investigation of Delamar Valley. A synthesis of these data are available in Volume I (FN-TR-27-DM-I).

The data in each section of this volume are preceded by an explanation of the format and terms used in the compilation.

FUGRO NATIONAL, INC.

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1.0 EXPLANATION OF ACTIVITY MAP AND GEOLOGIC STATION DATA

Locations of all field activities are shown in Drawing II-1-1, Activity Location Map (in pocket). The geodetic and Universal Transverse Mercator (UTM) coordinates of all activities are listed in Table II-1-1.

Geologic stations were established at selected locations throughout the valley at which detailed descriptions of surficial basin-fill deposits or rock were recorded. All data taken on surficial basin-fill units at the geologic stations are listed in Table II-1-2, and an explanation of the column headings in the table is given below. An example of the field data sheet is shown on Figure II-1-1. At stations where rock descriptions were made, only geologic unit designations are listed. A general explanation of all geologic unit symbols used in Verification studies is included at the end of this section.

Column Heading Table II-1-2	Explanation
Station Number	Geologic stations are numbered sequentially. (e.g., NDMG001; N= Nevada-Utah Study Area; DM= Valley abbreviation [Delamar]; G= Geology Station).
Geol. Unit	Generalized mapped geomorphic unit (see explanation below). The grain-size designations (s, g, and f) indicate sand, gravel, and fines, respectively.
MPS (mm)	Average Maximum Particle Size in millimeters.
Grain Size (%B, %C, %G, %S, %F)	Estimated particle size distribution using the Unified Soil Classification System. Percentages of boulders (%B) and cobbles (%C) are based on the entire deposit, whereas percentages of gravel (%G), sand (%S), and fines (%F)

are taken only on the fraction composed of particles less than 3 inches (76 mm) in diameter. Note: The symbol Ø (occasional) indicates between 1 and 5 percent; zero indicates 0 to 1 percent.

*	Laboratory analyses of selected soil samples using the Unified Soil Classification System.
USCS	Soil class according to the Unified Soil Classification System.
Munsell Color	Soil color based on standard Munsell Soil Color Charts.
Source Rock Types	Rock types of coarse clasts (gravel) listed in order of abundance.
Physical Properties	Data listed in columns 6 through 15 address specific soil properties. These are listed below in parentheses following the column heading number and are also listed at the bottom of Table II-1-1. Data are coded with each numerical entry referring to a specific soil condition as listed below.

6	(Grain Shape)	1) Angular, 2) Subangular, 3) Subrounded, 4) Rounded, 5) Well rounded
7	(Moisture Content)	1) Dry, 2) Slightly Moist, 3) Moist, 4) Very Moist, 5) Wet
8	(Plasticity of Fines)	1) None, 2) Low, 3) Medium, 4) High
9	(Consistency)	Coarse grained: 1) Very Loose, 2) Loose, 3) Medium Dense, 4) Dense, 5) Very Dense Fine grained: 1)Soft, 2) Firm, 3) Stiff, 4) Hard
10	(Structure)	1) Non-stratified, 2) Stratified, tabular, 3) Stratified, other (lensed, cross bedded, discontinuous beds)
11	(Cementation-Induration)	1) None, 2) Weak, 3) Moderate, 4) Strong
12	(Depth to Cemented Layer)	Depth to layer (in centimeters) exhibiting cementation-induration described in Column 11 (above)

13 (Weathering of clasts)	1) Fresh, 2) Slight, 3) Moderate, 4) Very
14 (Soil Profile Development)	1) None (A-C profile), 2) Poor (incipient B-horizon), 3) Well (prominant B-horizon)
15 (Caliche Development)	1) None, 2) Stage I, 3) Stage II, 4) Stage III, 5) Stage IV
Terrain	Terrain information at the data location is broken into the following categories:
Drainage Depth (ft)	Average depth of drainages (in feet)
Drainage Width (ft)	Average width of drainages (in feet)
Slope (%)	Average slope of ground surface (in percent grade)
Sample	Number of samples taken

GENERALIZED GEOLOGIC UNITS

Explanation

Surficial Basin-fill Units

A1 Younger Fluvial Deposits - Major recent stream channel and floodplain deposits.

A2 Older Fluvial Deposits - Older incised stream channel and floodplain deposits in elevated terraces bordering major recent drainages. Note: Not mapped in Delamar Valley.

A3 Eolian Deposits - Windblown deposits of sand occurring as either thin sheets (A3s) or dunes (A3d).

A4 Playa and Lacustrine Deposits - Deposits occurring in modern, active playas (A4) or in either inactive playas or older lake beds and abandoned shorelines associated with extinct lakes (A4o).

A5 Alluvial Fan Deposits - Alluvial deposits consisting of debris flow and water-laid alluvium near mountain fronts, grading into predominantly water-laid alluvium deposited in shifting distributary channels near the basin center. Younger (A5y), intermediate (A5i), and older (A5o) alluvial fans are differentiated by surface soil development, terrain conditions, and present depositional/erosional environment.

Grain sizes of these deposits (except A3 deposits, which are exclusively sandy) are indicated by a single letter (f, s, or g) following the geologic unit symbol. These letters indicate the predominant grain size and range of soil types according to the Unified Soil Classification System.

f - fine-grained clays and silts (ML, CL, MH, CH)

s - sands (SP, SW, SM, SC)

g - gravels (GP, GW, GM, GC)

ROCK UNITS

I Igneous (undifferentiated). Rocks formed by solidification of a molten or partially molten mass.

I1 Intrusive - Plutonic rocks formed by solidification of molten material beneath the surface (e.g., granite, granodiorite, diorite, gabbro).

I2 Extrusive (intermediate and acidic) - Volcanic rocks of intermediate and acidic compositon formed by solidification of molten material at or near the surface, (e.g., rhyolite, latite, dacite, andesite).

I3 Extrusive (basic) - Volcanic rocks of basic composition, generally formed by solidification of molten materials at or near the surface (e.g., basalt).

I4 Extrusive (pyroclastic) - Rocks formed by accumulation of volcanic ejecta (e.g., ash, tuff, welded tuff, agglomerate).

S Sedimentary (undifferentiated) - Rocks formed by accumulation of clastic solids, organic solids, and/or chemically precipitated minerals.

S1 Arenaceous and/or Siliceous Rocks - Composed of sand-size particles (e.g., sandstone, orthoquartzite) or of cryptocrystalline silica (e.g., opal, chert).

S2 Carbonate Rocks - Composed predominantly of calcium carbonate detritus or chemical precipitates (e.g., limestone, dolomite, chalk).

S3 Argillaceous Rocks - Composed of clay and silt-sized particles (e.g., siltstone, shale, claystone).

S4 Evaporite Rocks - Precipitated from solution as a result of evaporation (e.g., halite, gypsum, anhydrite, sylvite).

S5 Coarse Clastic Rocks - Composed of gravel sized or larger clasts (e.g., conglomerate, breccia).

M Metamorphic (undifferentiated) - Rocks formed through recrystallization in the solid state of preexisting rocks by heat and pressure (e.g., gneiss, schist, hornfels, metaquartzite).

DELAMAR VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	LAT. MIN	LONG. DEG	LONG. MIN	UTM COORD. ZONE 11 N(KM)	E(KM)
BORING SITES						
DM- B01	37	30.03	114	54.03	4152.26	685.59
DM- B02	37	32.19	114	49.42	4156.41	692.30
DM- B03	37	20.02	114	55.58	4133.70	683.71
DM- B04	37	23.67	114	50.16	4140.63	691.56
DM- B05	37	27.03	114	53.95	4146.72	685.83
DM-WRT1	37	26.63	114	52.08	4146.05	688.61
CPT SITES						
DM- C01	37	20.36	114	50.67	4134.49	690.96
DM- C02	37	20.91	114	49.82	4135.54	692.18
DM- C03	37	21.12	114	48.59	4135.97	693.99
DM- C04	37	23.67	114	50.16	4140.63	691.56
DM- C05	37	23.21	114	49.23	4139.81	692.96
DM- C06	37	22.50	114	48.55	4138.52	693.99
DM- C07	37	22.24	114	47.63	4138.07	695.36
DM- C08	37	35.40	114	53.34	4162.21	686.38
DM- C09	37	34.57	114	52.55	4160.70	687.58
DM- C10	37	33.84	114	51.90	4159.37	688.57
DM- C11	37	33.15	114	51.04	4158.13	689.86
DM- C12	37	32.66	114	50.26	4157.25	691.03
DM- C13	37	32.19	114	49.42	4156.41	692.30
DM- C14	37	31.54	114	48.44	4155.25	693.77
DM- C15	37	31.00	114	48.04	4154.25	694.38
DM- C16	37	29.22	114	47.58	4150.98	695.12
DM- C17	37	29.15	114	48.35	4150.83	693.99
DM- C18	37	29.60	114	50.00	4151.59	691.54
DM- C19	37	29.66	114	51.23	4151.66	689.73
DM- C20	37	29.83	114	52.40	4151.95	688.00
DM- C21	37	30.03	114	54.03	4152.26	685.59
DM- C22	37	30.18	114	55.10	4152.51	684.00
DM- C23	37	26.66	114	52.16	4146.09	688.49
DM- C24	37	26.83	114	52.95	4146.39	687.32
DM- C25	37	27.03	114	53.95	4146.72	685.83
DM- C26	37	27.32	114	55.46	4147.21	683.59
DM- C27	37	23.83	114	57.19	4140.70	681.19
DM- C28	37	24.21	114	55.67	4141.45	683.41
DM- C29	37	24.00	114	54.48	4141.09	685.17
DM- C30	37	23.96	114	53.50	4141.05	686.63
DM- C31	37	21.02	114	57.75	4135.49	680.47

GEODETIC AND UTM COORDINATES
OF ACTIVITY LOCATIONS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

TABLE
II-1-1
1 OF 6

FUGRO NATIONAL, INC.

DELAMAR VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	LAT. MIN	LONG. DEG	LONG. MIN	UTM COORD. ZONE 11 N(KM)	E(KM)
DM- C32	37	20.41	114	56.95	4134.37	681.68
DM- C33	37	20.02	114	55.58	4133.70	683.71
DM- C34	37	19.84	114	54.54	4133.39	685.26
DM- C35	37	19.71	114	53.52	4133.20	686.76
DM- C36	37	19.61	114	52.60	4133.04	688.13
DM- C37	37	19.60	114	51.21	4133.08	690.18
GEOLOGIC STATIONS						
DM-GS01	37	21.66	114	54.57	4136.77	685.14
DM-GS02	37	17.78	114	49.47	4129.77	692.84
DM-GS03	37	19.12	114	52.56	4132.14	688.21
DM-GS04	37	17.69	114	56.51	4129.35	682.43
DM-GS05	37	21.36	114	58.10	4136.10	679.94
DM-GS06	37	22.42	115	1.17	4137.96	675.36
DM-GS07	37	22.90	115	3.13	4138.80	672.46
DM-GS08	37	20.66	115	2.71	4134.67	673.16
DM-GS09	37	28.36	114	54.30	4149.17	685.26
DM-GS10	37	24.66	114	56.79	4142.25	681.74
DM-GS11	37	24.34	114	53.21	4141.76	687.04
DM-GS12	37	27.48	114	51.70	4147.62	689.13
DM-GS13	37	26.93	114	48.67	4146.71	693.62
DM-GS14	37	26.41	114	48.23	4145.76	694.29
DM-GS15	37	22.81	114	50.26	4139.04	691.45
DM-GS16	37	21.54	114	50.07	4136.69	691.78
DM-GS17	37	21.69	114	47.66	4137.06	695.34
DM-GS18	37	31.67	114	48.98	4155.47	692.96
DM-GS19	37	29.82	114	48.21	4152.06	694.17
DM-GS20	37	27.58	114	47.69	4147.94	695.03
DM-GS21	37	30.34	114	50.36	4152.97	690.98
DM-GS22	37	32.13	114	52.71	4156.19	687.44
DM-GS23	37	33.50	114	51.60	4158.76	689.03
DM-GS24	37	35.54	114	53.53	4162.47	686.10
DM-GS25	37	34.55	114	52.61	4160.66	687.49
DM-GS26	37	33.64	114	46.97	4159.18	695.83
DM-GS27	37	37.05	114	47.17	4165.49	695.39
DM-GS28	37	35.59	114	47.75	4162.75	694.60
DM-GS29	37	36.57	114	48.07	4164.55	694.08
DM-GS30	37	36.10	114	47.70	4163.70	694.66
DM-GS31	37	31.75	114	47.94	4155.65	694.49
DM-GS32	37	31.49	114	47.94	4155.17	694.50
DM-GS33	37	29.42	114	47.24	4151.36	695.62

GEODETIC AND UTM COORDINATES
OF ACTIVITY LOCATIONS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

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FUGRO NATIONAL, INC.

DELAMAR VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	LAT. MIN	LONG. DEG	LONG. MIN	UTM COORD. ZONE 11 N(KM)	E(KM)
DM-GS34	37	28.57	114	47.48	4149.79	695.30
DM-GS35	37	26.85	114	48.17	4146.58	694.36
DM-GS36	37	23.03	114	47.49	4139.53	695.53
DM-GS37	37	22.02	114	47.26	4137.67	695.91
DM-GS38	37	36.15	114	47.49	4163.80	694.96
DM-GS39	37	33.14	114	47.67	4158.22	694.83
DM-GS40	37	30.89	114	48.99	4154.02	692.98
DM-GS41	37	30.38	114	49.05	4153.08	692.91
DM-GS42	37	28.99	114	49.88	4150.47	691.75
DM-GS43	37	28.29	114	49.06	4149.21	692.98
DM-GS44	37	31.77	114	49.61	4155.63	692.02
DM-GS45	37	32.29	114	50.59	4156.56	690.56
DM-GS46	37	36.52	114	50.55	4164.39	690.43
DM-GS47	37	34.82	114	49.96	4161.25	691.38
DM-GS48	37	34.09	114	49.16	4159.93	692.59
DM-GS49	37	31.18	114	51.81	4154.46	688.82
DM-GS50	37	27.69	114	49.59	4148.08	692.23
DM-GS51	37	26.66	114	48.24	4146.22	694.27
DM-GS52	37	24.59	114	48.69	4142.39	693.69
DM-GS53	37	21.01	114	48.98	4135.75	693.42
DM-GS54	37	23.98	114	50.11	4141.20	691.62
DM-GS55	37	27.05	114	54.18	4146.74	685.48
DM-GS56	37	24.09	114	52.23	4141.33	688.48
DM-GS57	37	22.55	114	54.07	4138.44	685.83
DM-GS58	37	20.25	114	52.03	4134.24	688.95
DM-GS59	37	22.19	114	51.59	4137.85	689.52
DM-GS60	37	19.12	114	53.73	4132.10	686.48
DM-GS61	37	35.64	114	53.60	4162.65	685.99
DM-GS62	37	33.79	114	53.02	4159.25	686.92
DM-GS63	37	30.09	114	55.45	4152.33	683.49
DM-GS64	37	27.47	114	56.23	4147.46	682.46
DM-GS65	37	27.25	114	55.16	4147.09	684.04
DM-GS66	37	26.25	114	56.13	4145.21	682.64
DM-GS67	37	25.18	114	57.48	4143.19	680.70
DM-GS68	37	24.12	114	56.41	4141.26	682.32
DM-GS69	37	23.42	114	55.22	4140.00	684.10
DM-GS70	37	20.13	114	56.49	4133.88	682.36
DM-GS71	37	20.31	114	55.54	4134.24	683.77
DM-GS72	37	19.86	114	57.12	4133.36	681.44
DM-GS73	37	18.03	114	57.81	4129.94	680.50
DM-GS74	37	16.45	114	57.01	4127.04	681.74
DM-GS75	37	18.64	114	55.43	4131.16	683.99

GEODETIC AND UTM COORDINATES
OF ACTIVITY LOCATIONS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
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FUGRO NATIONAL, INC.

DELAMAR VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	LAT. MIN	LONG. DEG	LONG. MIN	UTM COORD. ZONE 11 N(KM)	E(KM)
DM-QS76	37	19.54	114	55.51	4132.82	683.83
DM-QS77	37	25.46	114	55.75	4143.76	683.24
DM-QS78	37	29.94	114	52.81	4152.14	687.39
DM-QS79	37	32.44	114	53.57	4156.73	686.17
REFRACTION LINES						
DM- S01	37	22.24	114	47.63	4138.07	695.36
DM- S02	37	29.83	114	52.40	4151.95	688.00
DM- S03	37	30.18	114	55.10	4152.51	684.00
DM- S04	37	29.22	114	47.58	4150.98	695.12
DM- S05	37	31.00	114	48.04	4154.25	694.38
DM- S06	37	24.21	114	55.67	4141.45	683.41
DM- S07	37	33.15	114	51.04	4158.13	689.86
DM- S08	37	23.83	114	57.19	4140.70	681.19
DM- S09	37	21.02	114	57.75	4135.49	680.47
DM- S10	37	20.41	114	56.95	4134.37	681.68
DM- S11	37	27.32	114	55.46	4147.21	683.59
DM- S12	37	35.40	114	53.34	4162.21	686.38
DM- S13	37	21.12	114	48.59	4135.97	693.99
RESISTIVITY LINES						
DM- R01	37	22.24	114	47.63	4138.07	695.36
DM- R02	37	29.83	114	52.40	4151.95	688.00
DM- R03	37	30.18	114	55.10	4152.51	684.00
DM- R04	37	29.22	114	47.58	4150.98	695.12
DM- R05	37	31.00	114	48.04	4154.25	694.38
DM- R06	37	24.21	114	55.67	4141.45	683.41
DM- R07	37	33.15	114	51.04	4158.13	689.86
DM- R08	37	23.83	114	57.19	4140.70	681.19
DM- R09	37	21.02	114	57.75	4135.49	680.47
DM- R10	37	20.41	114	56.95	4134.37	681.68
DM- R12	37	35.40	114	53.34	4162.21	686.38
DM- R13	37	21.12	114	48.59	4135.97	693.99
SURFICIAL SOIL SAMPLES						
DM-CS01	37	20.36	114	50.67	4134.49	690.96
DM-CS05	37	23.21	114	49.23	4139.81	692.96
DM-CS09	37	34.57	114	52.55	4160.70	687.58
DM-CS11	37	33.15	114	51.04	4158.13	689.86

GEODETIC AND UTM COORDINATES
OF ACTIVITY LOCATIONS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
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FUGRO NATIONAL, INC.

DELAMAR VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	LAT. MIN	LONG. DEG	LONG. MIN	UTM COORD. ZONE 11 N(KM)	E(KM)
DM-CS14	37	31.54	114	48.44	4155.25	693.77
DM-CS18	37	29.60	114	50.00	4151.59	691.54
DM-CS20	37	29.83	114	52.40	4151.95	688.00
DM-CS24	37	26.83	114	52.95	4146.39	687.32
DM-CS27	37	23.83	114	57.19	4140.70	681.19
DM-CS29	37	24.00	114	54.48	4141.09	685.17
DM-CS32	37	20.41	114	56.95	4134.37	681.68
DM-CS34	37	19.84	114	54.54	4133.39	685.26
DM-CS36	37	19.61	114	52.60	4133.04	688.13
TEST PITS						
DM- P01	37	19.71	114	53.52	4133.20	686.76
DM- P02	37	19.60	114	51.21	4133.08	690.18
DM- P03	37	20.91	114	49.82	4135.54	692.18
DM- P04	37	22.50	114	48.55	4138.52	693.99
DM- P05	37	35.40	114	53.34	4162.21	686.38
DM- P06	37	32.66	114	50.26	4157.25	691.03
DM- P07	37	32.19	114	49.42	4156.41	692.30
DM- P08	37	29.22	114	47.58	4150.98	695.12
DM- P09	37	29.66	114	51.23	4151.66	689.73
DM- P10	37	30.18	114	55.10	4152.51	684.00
DM- P11	37	27.32	114	55.46	4147.21	683.59
DM- P12	37	26.66	114	52.16	4146.09	688.49
DM- P13	37	23.96	114	53.50	4141.05	686.63
DM- P14	37	21.02	114	57.75	4135.49	680.47
TRENCH SITES						
DM- T01	37	33.84	114	51.90	4159.37	688.57
DM- T02	37	31.00	114	48.04	4154.25	694.38
DM- T03	37	29.15	114	48.35	4150.83	693.99
DM- T04	37	30.03	114	54.03	4152.26	685.59
DM- T05	37	27.03	114	53.95	4146.72	685.83
DM- T06	37	24.21	114	55.67	4141.45	683.41
DM- T07	37	20.02	114	55.58	4133.70	683.71
DM- T08	37	21.12	114	48.59	4135.97	693.99
DM- T09	37	22.24	114	47.63	4138.07	695.36
DM- T10	37	23.67	114	50.16	4140.63	691.56

GEODETIC AND UTM COORDINATES
OF ACTIVITY LOCATIONS
DELAMAR VALLEY, NEVADA

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FUGRO NATIONAL, INC.

DELAMAR VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	LAT. MIN	LONG. DEG	LONG. MIN	UTM COORD. ZONE 11 N(KM)	E(KM)
WATER WELL SITES						
DM- W01	37	34.67	114	52.71	4160.89	687.35
DM- W02	37	34.79	114	52.07	4161.14	688.28
DM- W03	37	21.02	114	45.69	4135.88	698.27
DM- W04	37	19.39	114	51.55	4132.66	689.69

GEODETIC AND UTM COORDINATES
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DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
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FUGRO NATIONAL, INC.

STATION NUMBER	GEOL UNIT	MPS MM	GRAIN SIZE %B	%C	%G	%S	%F	USCS	MUNSELL COLOR	SOURCE ROCK TYPES	PHYSICAL PROPERTIES 6	7	8	9	10	11	12	13	14	15	DRAINAGE DEPTH	(FT) WIDTH	SLOPE (%)	SAMPLE
NDMG001	A1 F		0	0	0	0	100	ML	7.5YR4/4			1	2	8	1	1			1	1	0.0	0.0	0	0
NDMG002	A5YS	185	0	0	30	62	8	SP-SM	5.0YR3/4	I2	3	3	1	2	1	1		2	1	1	3.3	3.3	4	0
NDMG003	A5IS	50	0	0	5	60	35	SC	7.5YR5/8	I2	3	3	2	2	1	2	47	2	3	3	3.3	13.1	2	0
NDMG004	A5YS	25	0	0	2	68	30	SM	7.5YR5/6	I2	3	3	1	3	1	1		2	2	1	0.0	0.0	0	0
NDMG005	A5YS	30	0	0	5	85	10	SP-SM	7.5YR4/4	I4	2	3	1	2	1	1		4	2	1	0.0	0.0	4	0
NDMG006	I2																							0
NDMG007	A5YS	15	0	0	0	85	15	SM	10.0YR4/6		3	3	1	3	1	1		2	1	1	1.6	16.4	2	0
NDMG008	I2																							0
NDMG009	A5IS	15	0	0	1	87	12	SP-SM	7.5YR4/4	I2	2	3	1	3	1	2	39	2	2	3	0.7	16.4	2	0
NDMG010	A5IS	75	0	0	15	65	20	SM	10.0YR6/6	I2	2	3	1	2	1	3	27	2	2	4	34.1	6.6	2	1
NDMG011	A1 F	17	0	0	0	40	60	ML	7.5YR3/4			3	1	7	1	1			1	1	0.0	.	0	0
NDMG012	A5YS	90	0	0	25	63	12	SP-SM	10.0YR4/6	I2	3	3	1	3	3	2	42	2	2	2	0.7	6.6	2	0
NDMG013	A5OG	80	0	0	60	28	12	GP-GM		I2 S2 M	3	3	1	3	3	2	31	3	1	4	16.4	65.6	4	0
NDMG014	A5IS	110	0	0	4	84	12	SP-SM	10.0YR6/4	I2 M I2	3	3	1	3	1	2	32	3	2	4	2.6	23.0	3	0
NDMG015	A5IS	140	0	0	30	40	30	SC	7.5YR3/4	I2	3	3	2	2	1	2	35	3	2	3	3.3	9.8	4	0
NDMG016	A5IS	110	0	0	30	58	12	SP-SM	10.0YR6/8	I2 I1 S2	2	3	1	2	1	2	45	3	2	3	3.3	9.8	3	0
NDMG017	A5IG	35	0	0	55	25	20	GM		I2	2	3	1	3	1	2	35	3	2	3	8.2	13.1	8	0
NDMG018	A5YS	90	0	0	40	50	10	SP-SM	10.0YR4/4	I2 S2	2	3	1	3	1	1		2	2	2	3.3	9.8	6	0
NDMG019	A5IG	110	0	0	50	20	30	GM		I2 M	2	3	2	3	3	2	37	3	2	2	6.6	9.8	5	0
NDMG020	A5IG	155	0	20	50	20	30	GC		M I2	2	3	3	3	1	1		2	3	2	9.8	13.1	8	0
NDMG021	A5YS	60	0	0	10	85	5	SP-SM	7.5YR3/4	I2	3	3	1	3	1	1		2	1	1	1.0	3.3	2	0
NDMG022	A5YS	52	0	0	3	89	8	SP-SM	10.0YR5/4	I2	2	3	1	2	1	1		2	1	1	0.7	23.0	2	1
NDMG023	A5YS	30	0	0	1	91	8	SP-SM	7.5YR3/4	I2	3	3	1	3	1	1		2	1	1	0.3	3.3	2	1
NDMG024	A5IS	60	0	0	2	93	5	SP-SM	10.0YR4/4	I2	2	3	1	2	1			3	1	3			2	0
NDMG025	A5YS	35	0	0	0	95	5	SP-SM	7.5YR4/4		3	3	1	2	1	1		2	1	2	0.0	0.0	1	0
NDMG026	A5IS	80	0	0	3	92	5	SP-SM	7.5YR4/6	I2	2	3	1	3	1	2	41	2	3	2	3.3	13.1	6	1
NDMG027	A5IS	75	0	0	15	70	15	SM	10.0YR4/4	S2	2	3	2	2	3	2	47	2	2	2	3.3	13.1	6	0
NDMG028	A5IS	60	0	0	2	93	5	SP-SM	7.5YR5/4	I2 S2	3	3	1	2	1	2	29	2	2	2	3.3	9.8	2	1
NDMG029	A5IS	150	0	0	0	80	20 #	SM	7.5YR4/4	I2 I4	2	3	3	2	1	3	24	2	2	4	1.6	65.6	4	1
NDMG030	A5IS	25	0	0	5	70	25 #	SM	10.0YR4/4		2	1	3	2	1	3	23	2	1	4	3.3	32.8	4	1
NDMG031	A5YS	130	0	5	40	55	5	SP-SM	10.0YR3/3	S2 I4	1	1	1	2	3	1		2	1	2	1.6	3.3	8	0
NDMG032	S2																							1
NDMG033	S1																							1
NDMG034	A5OS	115	0	10	25	55	20 #	SM	10.0YR4/4	S1 I2 S2 I4	2	1	2	2	1	4	27	2	1	4	9.8	32.8	6	1
NDMG035	A5OS	130	0	0	40	57	3	SP	10.0YR4/4	I2 S1	2	1	3	1	1	2		2	1	2	12.0	150.0	4	0
NDMG036	A5IS	140	0	10	25	65	10	SP-SM	10.0YR4/4	I4 S2	2	1	3	3	1	3	10	2	1	4	6.6	32.8	6	0
NDMG037	I2																							1
NDMG038	A1 S	105	0	0	20	76	4 #	SP	10.0YR3/3	I4 S2														1
NDMG039	A5IS	70	0	0	10	80	10 #	SP-SM	10.0YR4/3	I4 S1	2	3	1	4	1	2	21	3	2	4	3.3	23.0	4	0
NDMG040	A5IS	140	0	10	15	65	20 #	SM	10.0YR4/4	I4 I3	2	1	2	3	1	2	22	2	2	3	3.3	32.8	4	1
NDMG041	A5YS	130	0	20	30	63	7	SP-SM	10.0YR4/3	I4 S2 I3	2	1	1	3	1	3	42	2	1	2	3.3	32.8	5	0
NDMG042	A5YS	90	0	0	5	85	10	SP-SM	10.0YR3/4	I4 I3	2	1	1	3	1	1		3	1	2	1.6	13.1	3	0
NDMG043	A5IS	220	0	5	15	60	25 #	SM	10.0YR4/3	S1 I3 I4 S2	2	1	1	4	1	3	17	3	1	3	6.6	23.0	5	1
NDMG044	A5IS	70	0	0	8	88	4	SP	10.0YR4/3	I3 I4	2	1	2	3	1	3	42	3	1	3	3.3	16.4	4	0
NDMG045	I4																							1
NDMG046	A5YS	15	0	0	2	73	25 #	SM	10.0YR4/4		2	1	2	2	1	2	30	3	1	2	0.3	3.3	2	1
NDMG047	A5IS	105	0	0	3	92	5	SP-SM	10.0YR4/4	I4	2	1	2	3	1	3	38	3	1	4	1.6	3.3	2	0
NDMG048	A5IS	150	0	0	10	80	10 #	SP-SM	10.0YR4/4	I4 I2	2	1	2	3	1	3	28	3	1	4	1.6	3.3	2	1
NDMG049	A5YS	70	0	0	30	65	5 #	SP-SM	10.0YR3/6	I3 S2 I4	2	1	1	3	3	1		2	1	2	1.0	3.3	2	1
NDMG050	A5IS	140	0	5	15	65	20 #	SM	10.0YR4/4	S1 I3 I4	2	1	2	2	1	3	42	2	1	4	4.9	23.0	2	1
NDMG051	A1 G	150	0	10	60	40	0	GP		S1 I3 I4	2	3	1	2	3	1		2	1	1	3.3	16.4	4	0
NDMG052	A5IG	100	0	20	45	40	15	GM		S2 S1 I3	2	1	2	3	3	2	32	3	1	3	4.9	16.4	5	0
NDMG053	A5IS	85	0	0	10	78	12	SP-SM	10.0YR4/6	I4 I2 S2	2	1	1	3	1	2	30	3	1	4	1.6	9.8	8	0
NDMG054	A5YS	20	0	0	1	74	25 #	SM	10.0YR4/4		2	1	1	4	1	3	7	3	1	1	1.6	6.6	1	1
NDMG055	A1 S	25	0	0	8	85	7	SP-SM	10.0YR3/4	I4 I3	2	1	1	2	3	2	45	3	1	2	1.6	9.8	2	0
NDMG056	A5YS	75	0	0	40	48	12 #	SP-SM	10.0YR4/4	I4 I3	2	1	1	3	3	2	17	3	1	2	0.3	3.3	1	1
NDMG057	A1 F	6	0	0	0	25	75 #	ML	10.0YR3/4			1	1	7	1	1			1	1	1.6	6.6	1	1
NDMG058	A5IS	70	0	0	5	80	15	SM	10.0YR5/6	I4 I3	2	1	2	3	1	3	46	3	1	4	4.9	9.8	2	0
NDMG059	A5YS	75	0	0	10	78	12	SP-SM	10.0YR4/4	I4 I3	2	1	1	2	3	1		2	1	2	0.3	16.4	4	0
NDMG060	A5YS	30	0	0	10	70	20 #	SM	10.0YR4/4	I4 I3	2	1	2	3	3	3	27	3	1	4	1.0	3.3	3	1
NDMG061	I4																							1
NDMG062	A3DS	6	0	0	0	96	4 #	SP	10.0YR4/4		2	1	1	2	1	1			1	1	1.6	9.8	5	1
NDMG063	I4																							1
NDMG064	I4																							1
NDMG065	A5YS	4	0	0	5	60	35 #	SM	10.0YR4/4		2	1	2	2	1	1		2	1	2	1.6	3.3	1	1
NDMG066	A5IS	6	0	0	15	55	30	SM	10.0YR4/4	I4	2	1	2	3	1	1		2	2	2	1.6	3.3	4	0
NDMG067	A5IS	140	0	0	10	75	15	SM	10.0YR4/4	I4 I2	2	1	1	3	1	3	30	2	2	5	3.3	6.6	3	0
NDMG068	I4																							1
NDMG069	A5YS		0	0	0	60	40 #	SM	10.0YR5/4		2	1	1	3	1	1		2	1	1	1.6	3.3	2	1
NDMG070	I4																							1
NDMG071	A5YS	20	0	0	0	60	40 #	SM	10.0YR4/4		2	1	1	3	1	1		2	1	2	1.6	3.3	1	1
NDMG072	A4 F		0	0	0	0	100 #	CL	10.0YR4/4			1	3	9	1	1			1	1			0	1
NDMG073	A5YS	20	0	0	0	60	40	SM	10.0YR4/4		2	1	2	3	1	1		2	1	2	1.6	3.3	1	0
NDMG074	A5IS	260	0	5	20	45	35 #	SM	10.0YR4/4	I4	2	1	2	4	1	3	37	2	2	3	0.3	6.6	3	1
NDMG075	A5YS	60	0	0	10	75	15	SM	10.0YR4/4	I2 I4	2	1	1	3	1	1		2	1	2	1.6	3.3		0
NDMG076	A5YS		0	0	0	65	35 #	SM	10.0YR3/4		2	1	2	3	1	1		2	1	1	1.6	3.3	1	1
NDMG077	A5YS	5	0	0	7	68	25 #	SM	10.0YR4/3		2	1	1	2	1	1		2	1	2	1.6	3.3	2	1
NDMG078	I4																							1
NDMG079	A5IS	30	0	0	0	80	20	SM	10.0YR4/4		2	1	1	3	1	4	38	2	1	4	6.6	26.2	1	0

EXPLANATION: PHYSICAL PROPERTIES

6: GRAIN SHAPE
7: MOISTURE CONTENT
8: PLASTICITY OF FINES
9: CONSISTENCY
10: STRUCTURE
11: CEMENTATION-INDURATION
12: DEPTH TO CEMENTED LAYER (CM)
13: WEATHERING OF CLASTS
14: SOIL PROFILE DEVELOPMENT
15: CALICHE DEVELOPMENT
NOTE: 0=OCCASIONAL (1-5%)
#=LAB DATA

GEOLOGIC STATION DATA
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE — BMO

TABLE II-1-2

FUGRO NATIONAL, INC.

Station No. _____ Described Geol. Unit _____

Date _____ Complete Geol. Unit _____

Observers _____ Field Photo Nos. _____

Air Photo No. _____ Sample (No=0, Yes=1) _____

SOIL PROPERTIES

1. Grain-Size Distribution: MPS (mm) - grain size of coarsest fraction; boulders and cobbles - percent of total; gravel, sand, and fines - percent less than 3 inches.

2. USCS Symbol

3. Descriptive Name (one adjective only) _____

4. Munsell Color (not applicable to gravel)

5. Lithology of gravel, cobbles, boulders: give rock type (I1, I2, M, etc.) in order of abundance.

6. Grain Shape (coarse grained soil only): 1) Angular, 2) Subangular, 3) Subrounded, 4) Rounded, 5) Well-rounded.

7. Moisture Content: 1) Dry, 2) Slightly moist, 3) Moist, 4) Very moist, 5) Wet

8. Plasticity of Fines: 1) None, 2) Low, 3) Medium, 4) High

9. Consistency:
   Coarse-grained: 1) Very Loose, 2) Loose, 3) Medium Dense, 4) Dense, 5) Very Dense
   Fine-grained: 6) Soft, 7) Firm, 8) Stiff, 9) Hard

10. Structure: 1) Non-stratified (homogeneous), 2) Stratified-tabular, 3) Stratified-other; if 3) describe _____

11. Cementation-Induration: 1) None, 2) Weak, 3) Moderate, 4) Strong

12. Depth to Cemented Layer (cm)

13. Weathering of boulders, cobbles, and gravel: 1) Fresh, 2) Slight, 3) Moderate, 4) Very

14. Degree of Soil Profile Development: 1) None (A-C profile), 2) Poor (incipient B-horizon), 3) Well (prominant B-horizon)
    Describe _____

15. Degree of Caliche Development: 1) None, 2) Stage I, 3) Stage II, 4) Stage III, 5) Stage IV
    Describe _____

FIELD DATA SHEET
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE — BMO

FIGURE II-1-1 1 OF 2

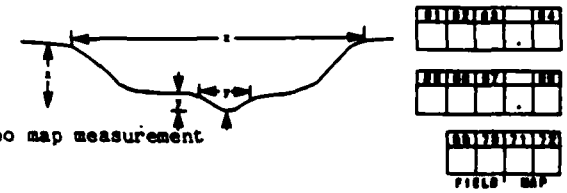
FUGRO NATIONAL, INC.

TERRAIN

16. Average Drainage Depth (ft)

17. Average Drainage Width (ft)

18. Slope (percent) - field and/or topo map measurement



SURFACE FEATURES

19. Pit Depth (cm) _____

20. Thickness of Vesicular Silt (cm) _____

21. Desert Pavement Development
(None, Poor, Moderate, Well) _____

22. Patina Development
(None, Moderate, Well) _____

COMMENTS

_____

_____

_____

_____

ROCK DESCRIPTIONS

23. Rock Type/Formation _____

24. Color, Grain size, Hardness, Texture _____

_____

25. Degree of Weathering _____

26. Structure
Bedding Characteristics _____

Bedding Attitude _____

Fracture, Joint _____

27. Secondary Alteration/Mineralization _____

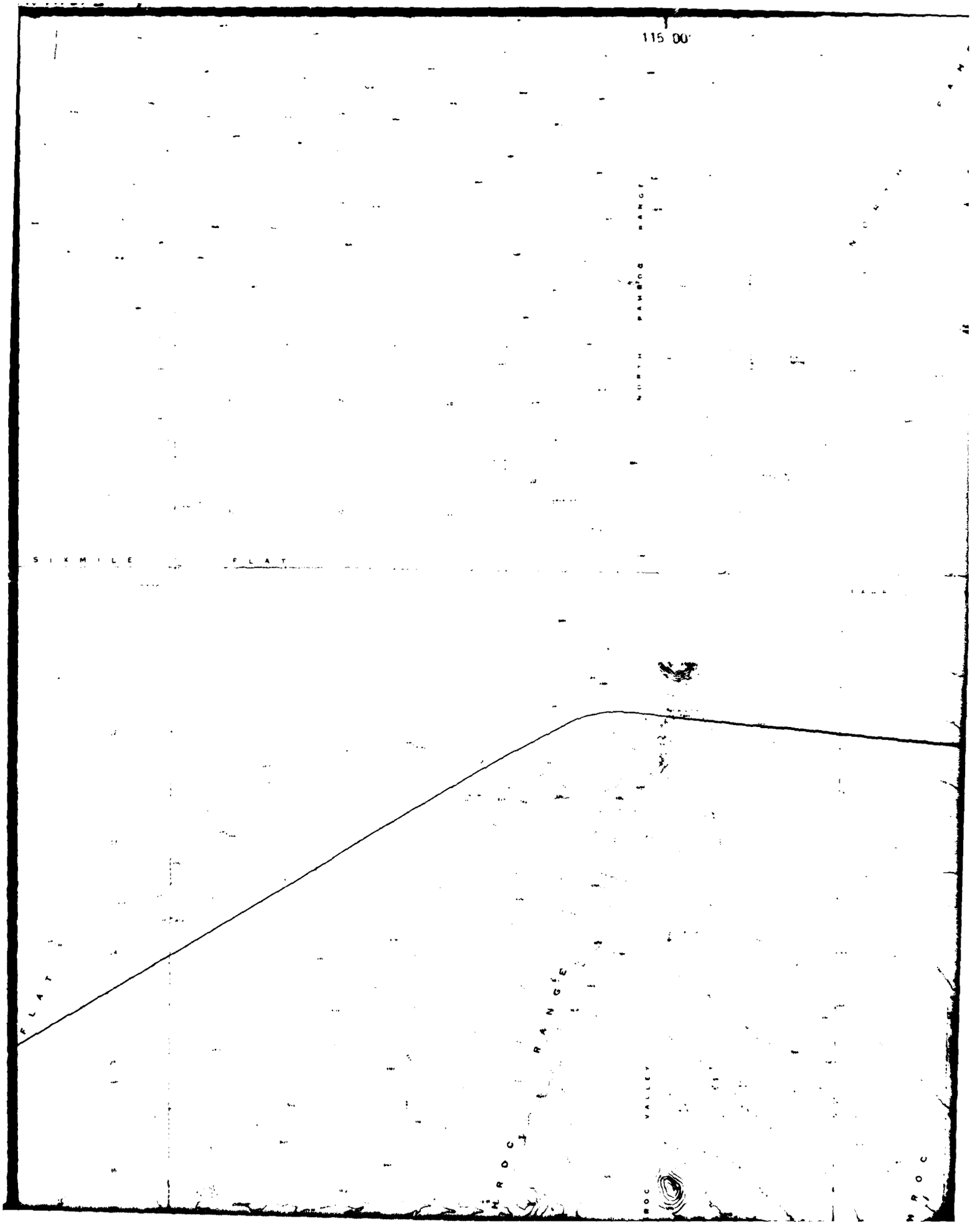
_____

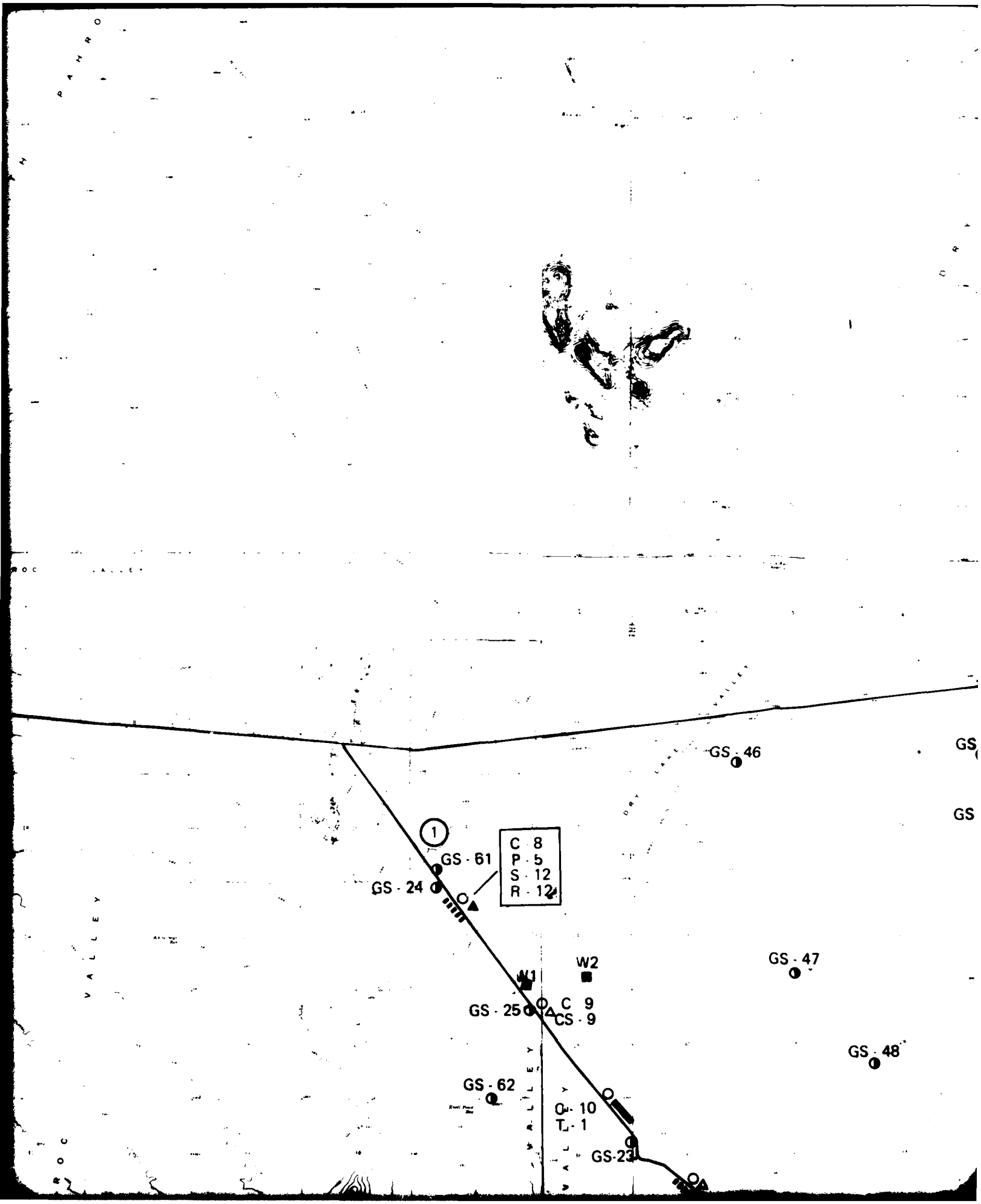
FIELD DATA SHEET
DELAMAR VALLEY, NEVADA

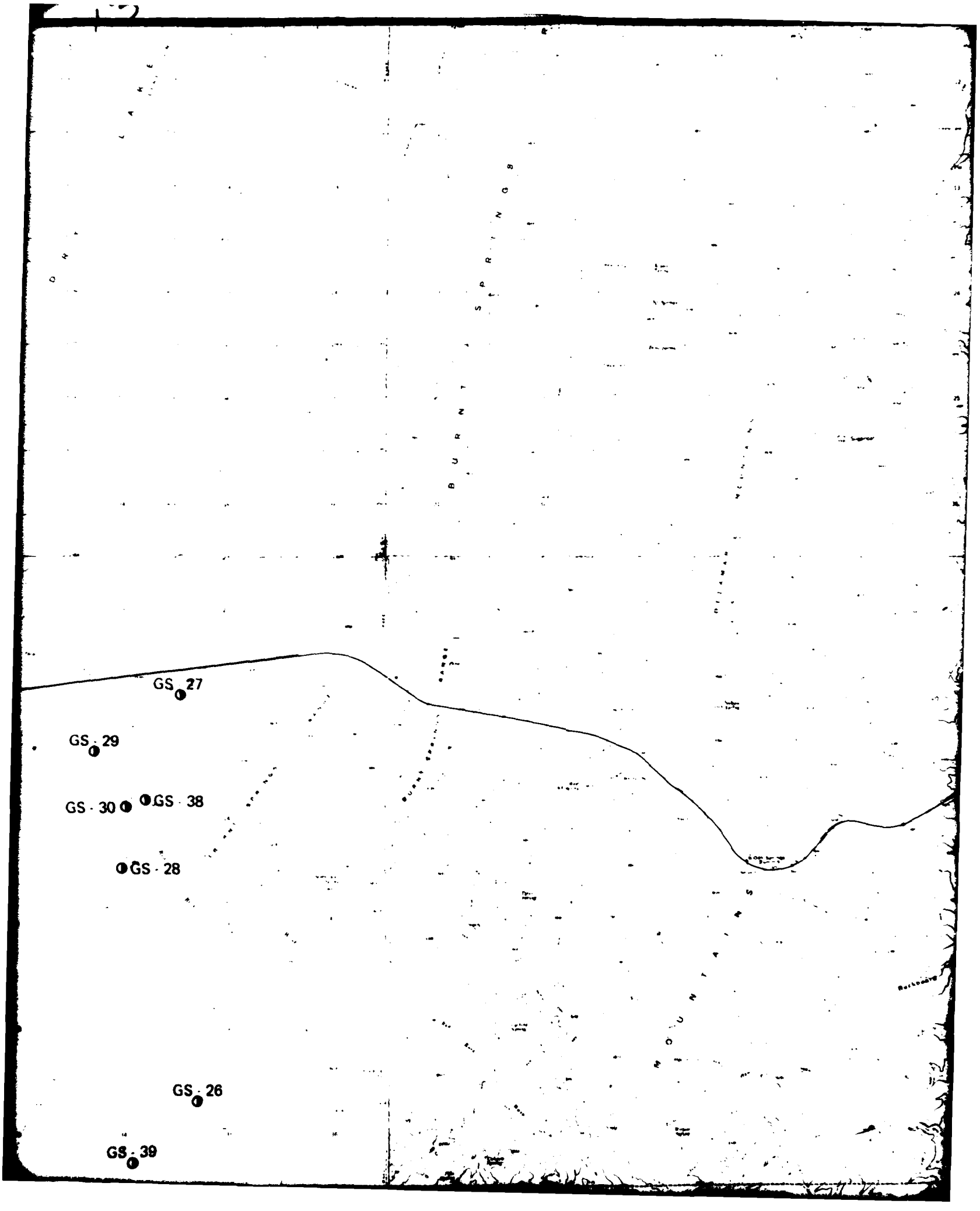
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

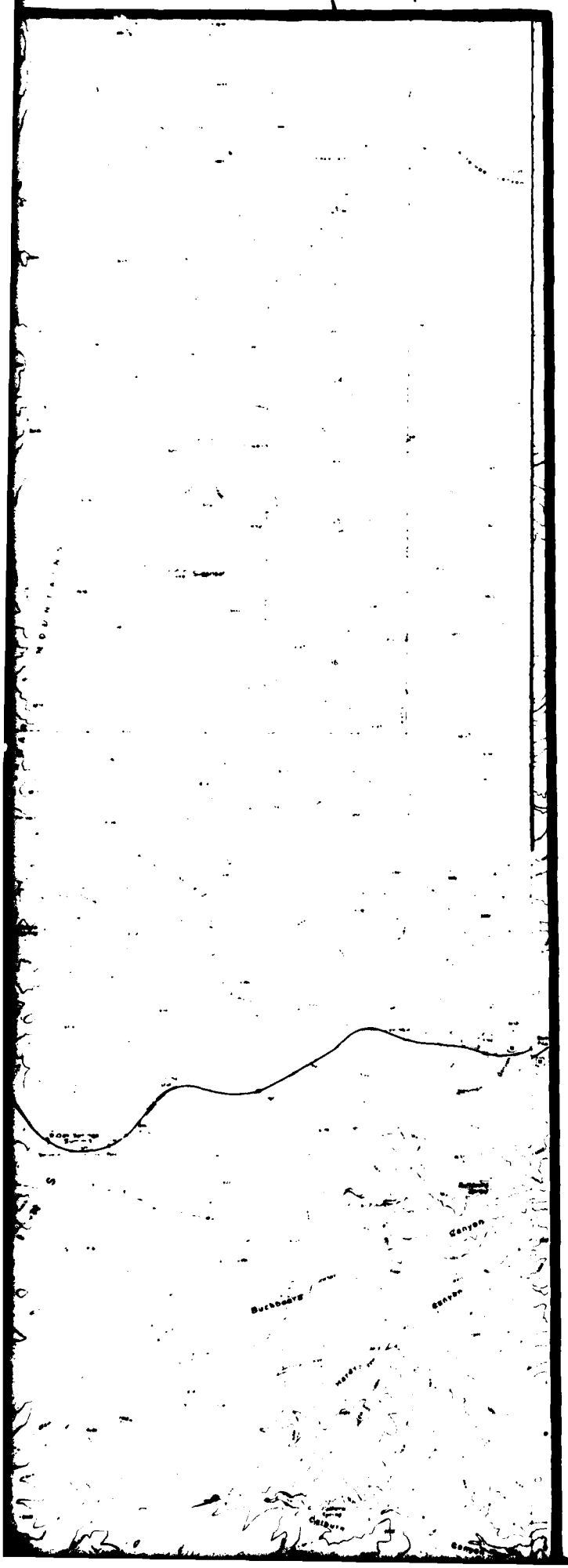
FIGURE
II-1-1
2 OF 2

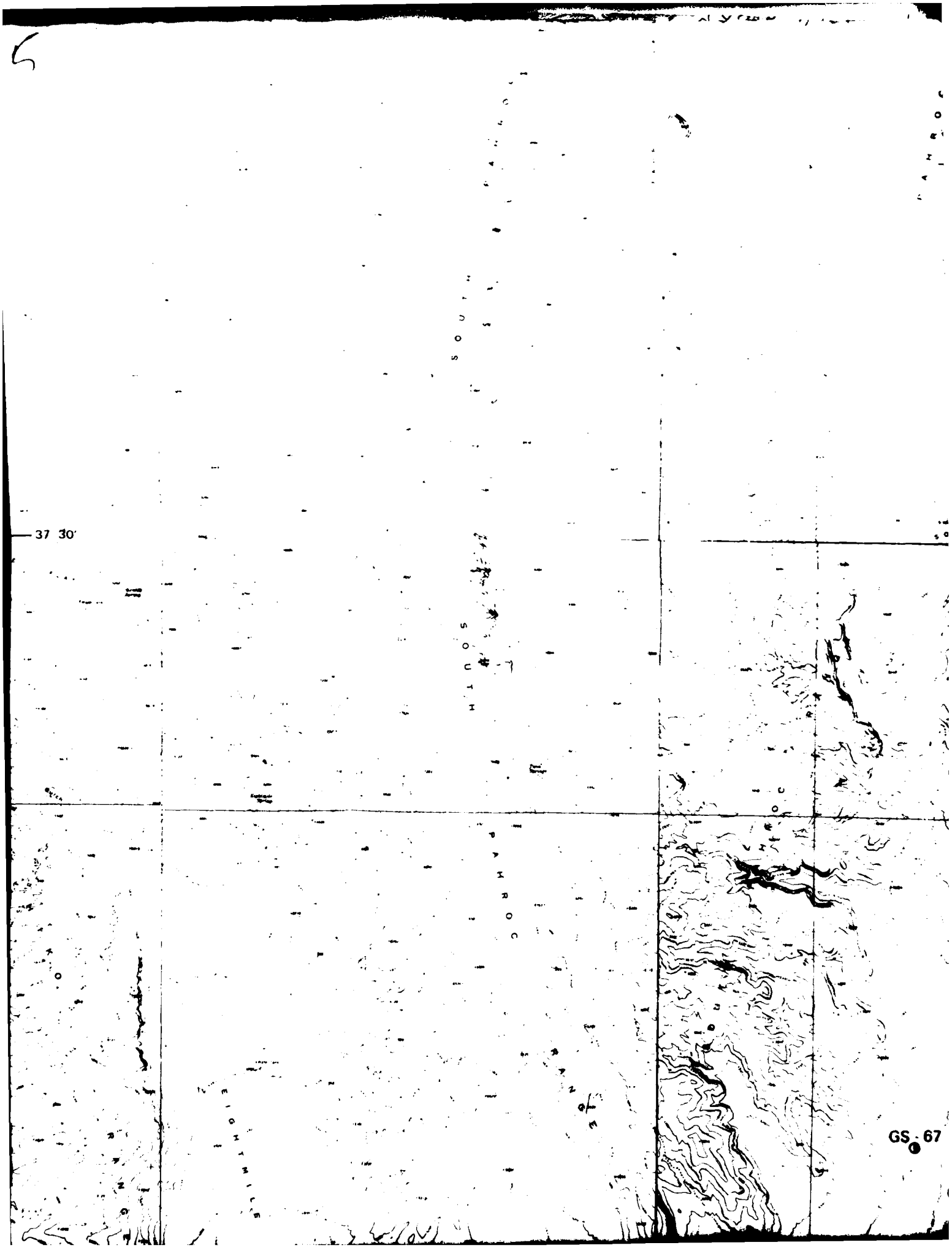
FUGRO NATIONAL, INC.

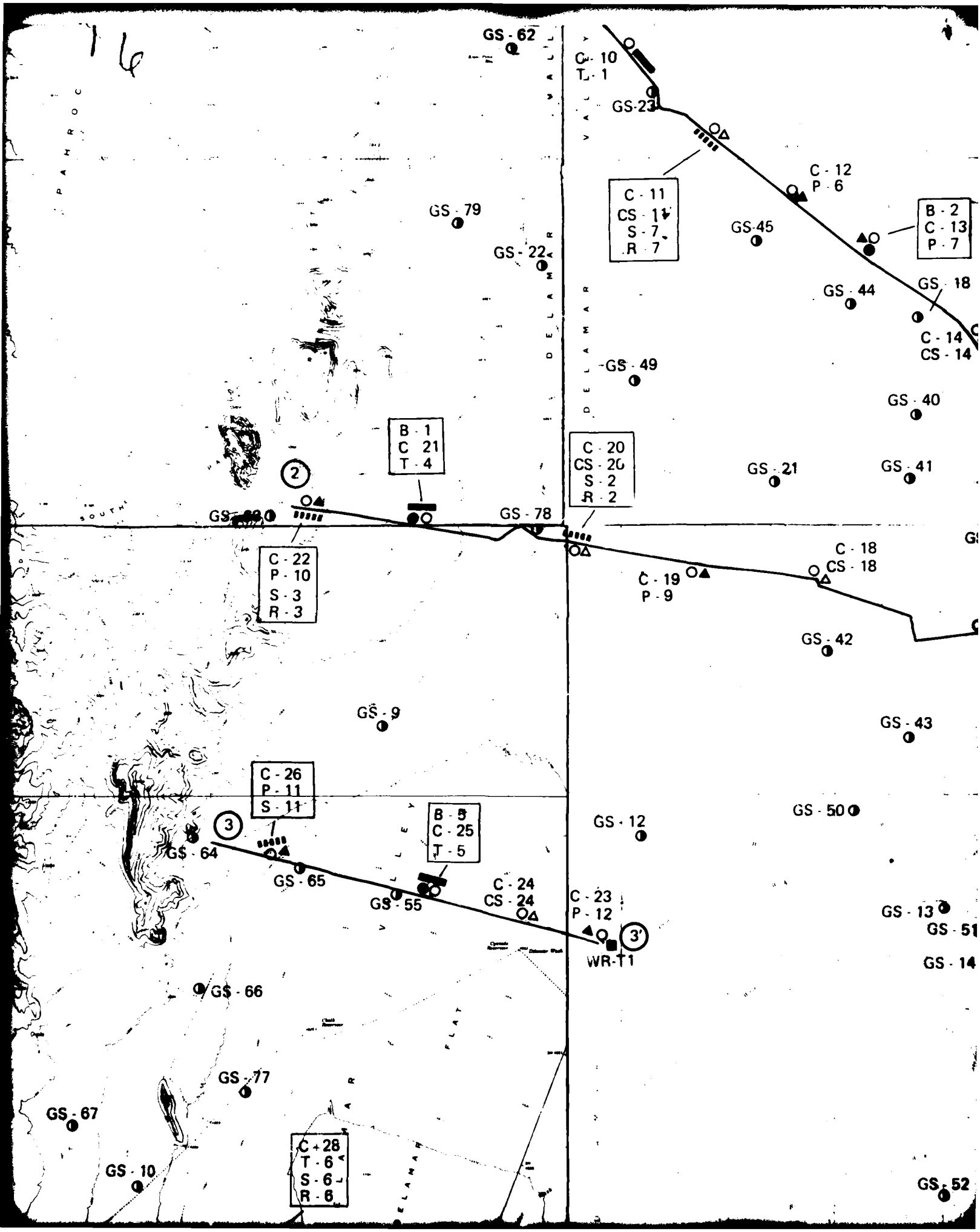

115 00'
NORTH PAHROC RANGE
SIXMILE FLAT
FLAT
PAHROC RANGE
PAHROC VALLEY
PAHROC

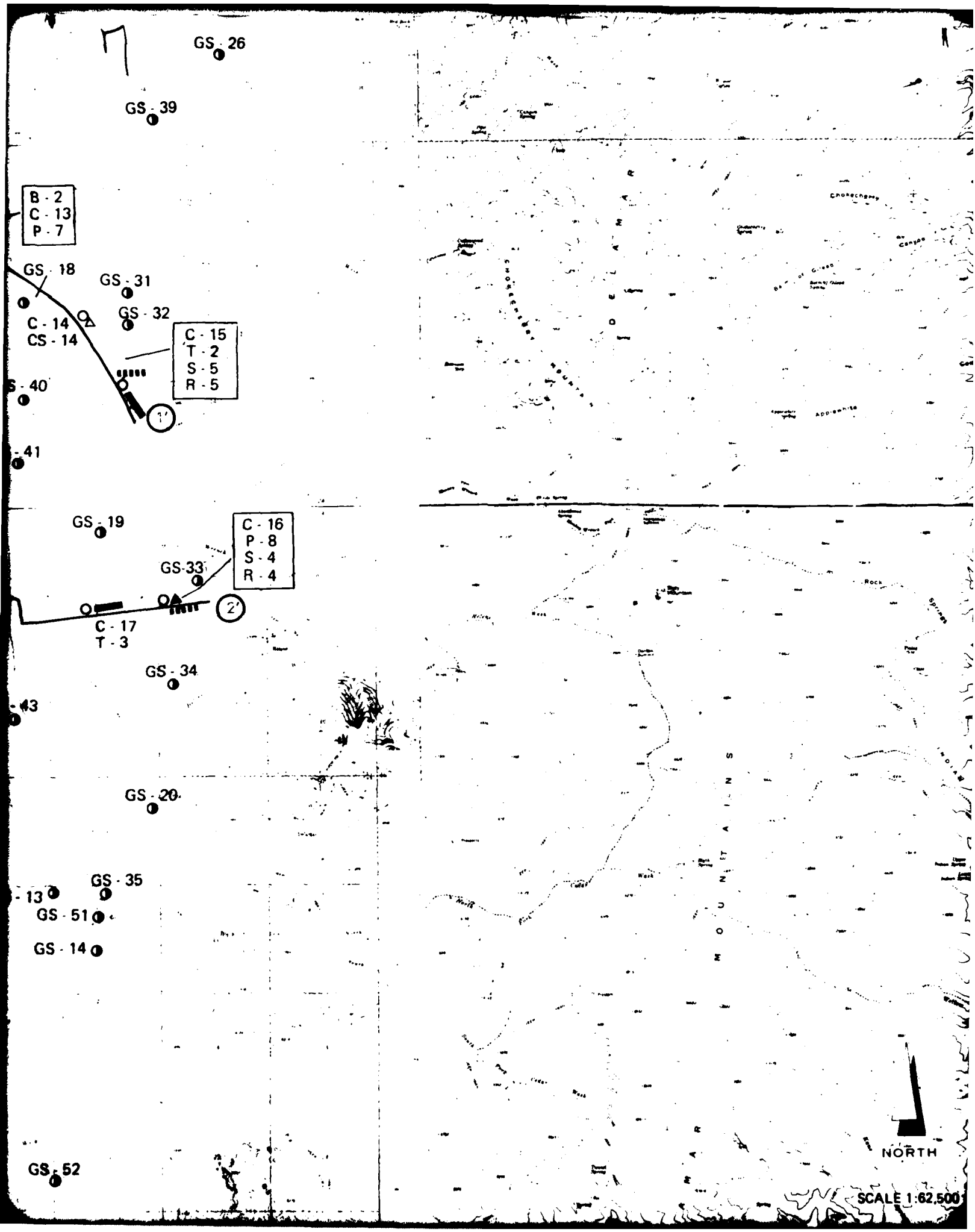

GS - 46
GS
GS
1
GS - 61
GS - 24
C 8
P 5
S 12
R 12
W2
W1
GS - 47
GS - 25
C 9
CS - 9
GS - 48
GS - 62
O - 10
T - 1
GS-23


BURNT SPRINGS
GS 27
GS 29
GS 30
GS 38
GS 28
GS 26
GS 39

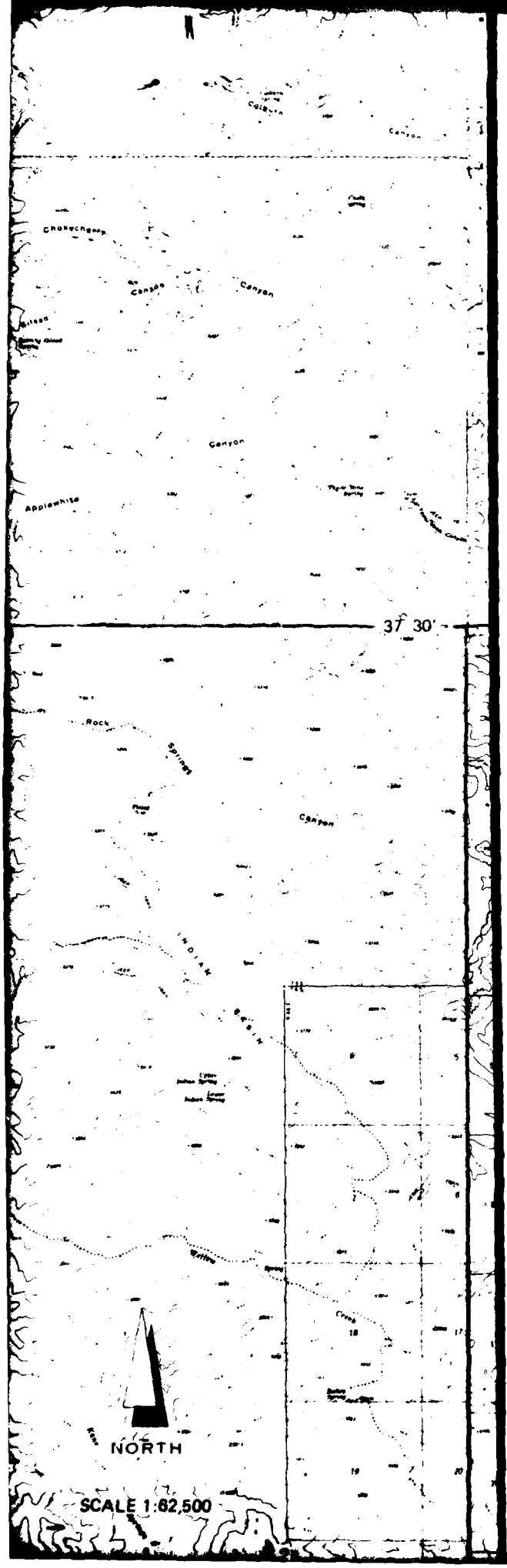

Buckeye
Canyon
Canyon

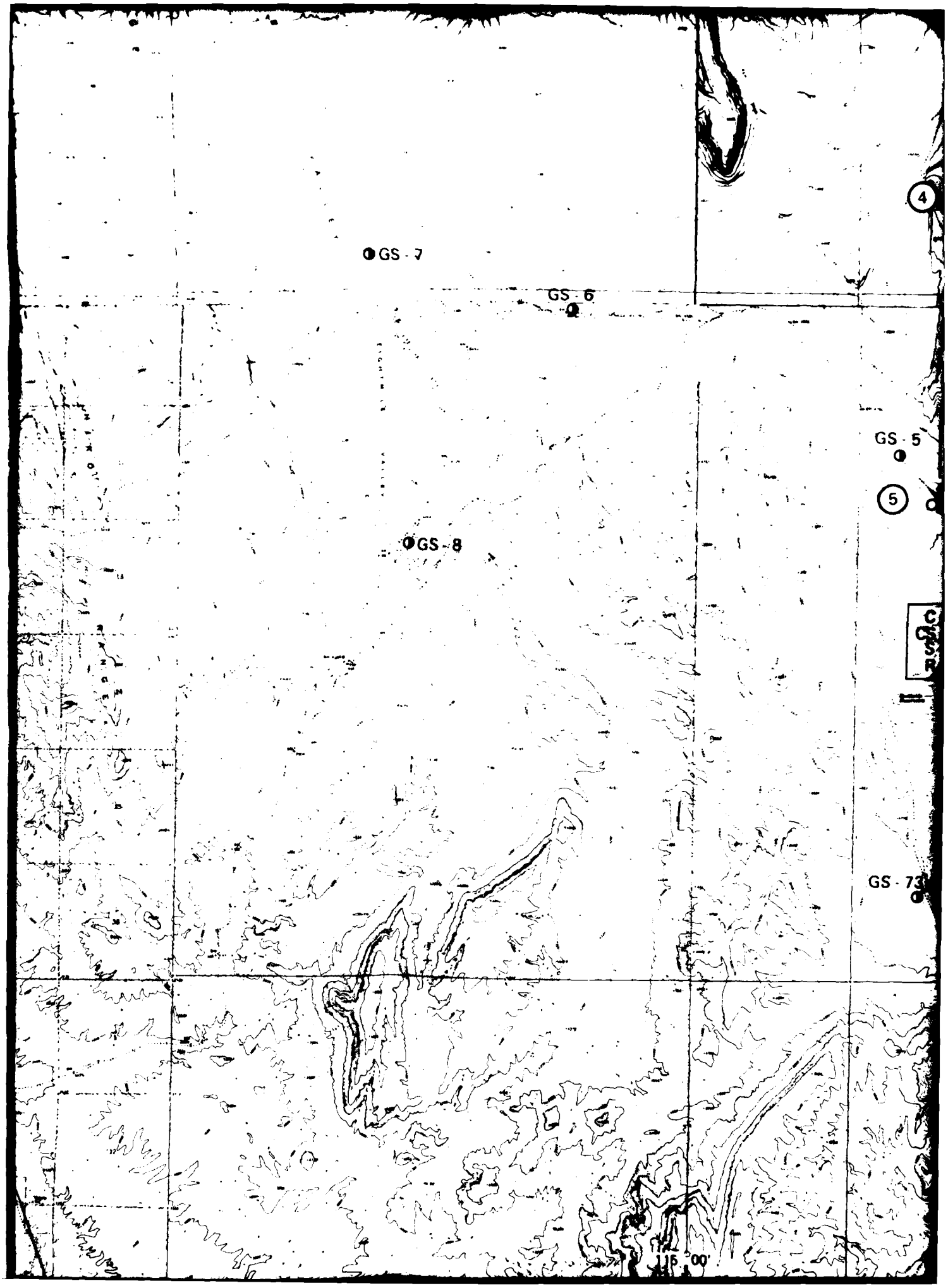

37 30'
SOUTH
GS 67

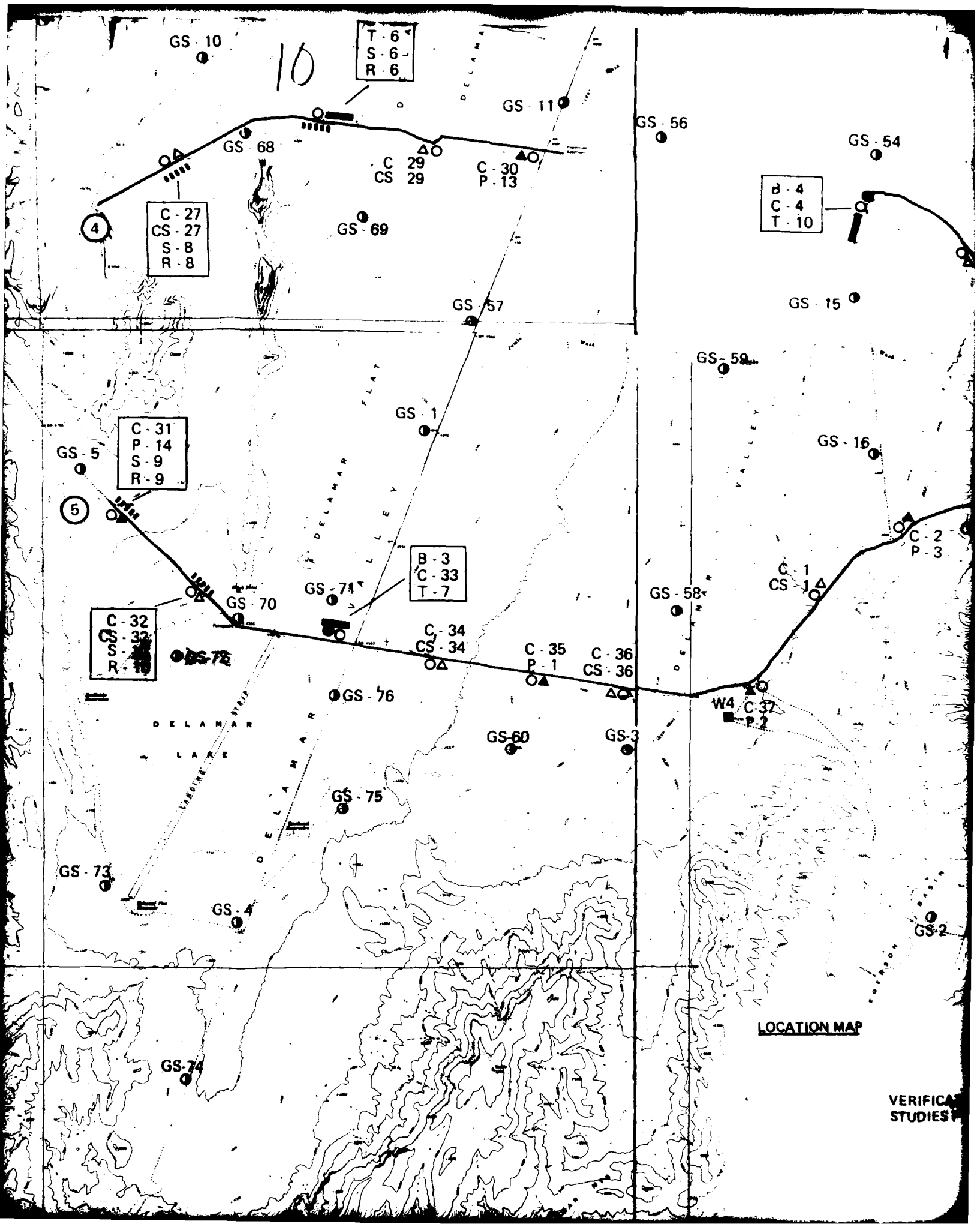

16
GS - 62
C - 10
T - 1
GS-23
C - 11
CS - 11
S - 7
R - 7
C - 12
P - 6
B - 2
C - 13
P - 7
GS-45
GS - 79
GS - 22
GS - 44
GS - 18
C - 14
CS - 14
GS - 49
GS - 40
B - 1
C - 21
T - 4
C - 20
CS - 20
S - 2
R - 2
GS - 21
GS - 41
2
GS - 78
C - 22
P - 10
S - 3
R - 3
C - 18
CS - 18
C - 19
P - 9
GS - 42
GS - 9
GS - 43
C - 26
P - 11
S - 11
B - 5
C - 25
T - 5
GS - 50
GS - 12
3
GS - 64
GS - 65
GS - 55
C - 24
CS - 24
C - 23
P - 12
3'
WR-T1
GS - 13
GS - 51
GS - 14
GS - 66
GS - 77
GS - 67
C - 28
T - 6
S - 6
R - 6
GS - 10
GS - 52


GS - 26
GS - 39
B - 2
C - 13
P - 7
GS - 18
GS - 31
GS - 32
C - 14
CS - 14
C - 15
T - 2
S - 5
R - 5
1'
S - 40
- 41
GS - 19
C - 16
P - 8
S - 4
R - 4
GS-33
2'
C - 17
T - 3
GS - 34
- 43
GS - 20
GS - 35
- 13
GS - 51
GS - 14
GS - 52
NORTH
SCALE 1:62,500

8


Canyon
Canyon
Canyon
Applewhite
37°30'
Rock
Springs
Canyon
INDIAN
BASIN
NORTH
SCALE 1:62,500


GS - 7
GS - 6
GS - 5
GS - 8
GS - 73
4
5
115 00'


10
T - 6
S - 6
R - 6
GS - 10
GS - 11
GS - 68
C - 29
CS 29
C - 30
P - 13
C - 27
CS - 27
S - 8
R - 8
4
GS - 69
GS - 56
GS - 54
B - 4
C - 4
T - 10
GS - 15
GS - 57
GS - 59
GS - 1
C - 31
P - 14
S - 9
R - 9
GS - 5
5
GS - 16
C - 2
P - 3
B - 3
C - 33
T - 7
GS - 71
GS - 70
C - 32
CS - 32
GS - 58
C - 1
CS - 1
C - 34
CS - 34
C - 35
P - 1
C - 36
CS - 36
GS - 76
W4
C - 37
P - 2
GS-60
GS-3
GS - 75
GS - 73
GS - 4
GS-2
GS-74
DELAMAR FLAT
DELAMAR VALLEY
DELAMAR LAKE
LANDING STRIP
LOCATION MAP
VERIFICA
STUDIES

GS - 52

GS - 54

C - 5
CS - 5

GS - 36

C - 7
T - 9
S - 1
R - 1

C - 6
P - 4

GS - 37

GS-17

GS - 16

W3

C - 2
P - 3

GS - 53

C - 3
T - 8
S - 13
R - 13

GS-2

EXPL

GS-1

W1
WR

B-1

C-1

CS-1

T-1

P-1

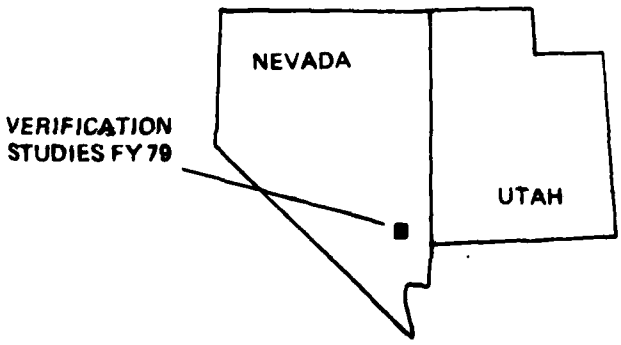
S-1

R-1

1 — 1'

NOTE: Due to t
of any c
or the C
located a

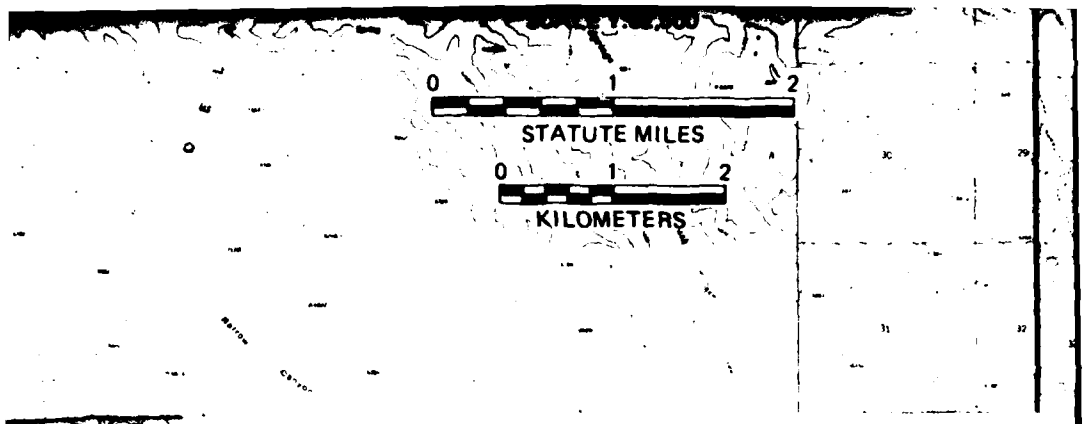
N MAP



ACTIVIT
DEL

MX SITING
DEPARTMENT OF

FUGRO



EXPLANATION

◐	GS-1	GEOLOGIC STATION
■	W1 WR	GROUND WATER LEVEL MEASUREMENT
●	B-1	BORING
○	C-1	CONE PENETROMETER TEST (CPT)
△	CS-1	SURFACE SAMPLE AT CPT LOCATION
▬	T-1	TRENCH
▲	P-1	TEST PIT
▮▮▮▮▮	S-1	SEISMIC REFRACTION LINE
	R-1	ELECTRICAL RESISITIVITY LINE
(1)—(1')		ACTIVITY LINE

NOTE: Due to the exaggeration of the map symbols, the exact location of any combination of activities is where either the boring (1st) or the CPT (2nd) is situated. Single activities are most accurately located nearest the center of the symbol.

ACTIVITY LOCATION MAP
DELAMAR, NEVADA

MX SITING INVESTIGATION

DEPARTMENT OF THE AIR FORCE – BMO

DRAWING

II-1-1

FUGRO NATIONAL, INC.

2.0 EXPLANATION OF GROUND-WATER DATA

Existing ground-water data in Delamar Valley were collected from all available sources. These data were updated where possible from measurements taken during Fugro field operations, and all data are shown in Table II-2-1. Locations of water wells and boreholes in which water-level measurements were available are shown in Drawing II-1-1. Well numbers listed in the left hand column of Table II-2-1 refer to well locations shown on Drawing II-1-1. Actual well numbers giving location, according to the Bureau of Land Management Land Survey System, are shown in the second column.

Water levels generally refer to the static ground-water table in the unconfined basin-fill aquifer. Perched conditions or levels in artesian aquifers are noted where known.

WELL NO.	WELL LOCATION NUMBER*	ELEVATION OF GROUND SURFACE-FEET (METERS) ABOVE M.S.L.	DEPTH OF WELL-FEET (METERS)	WATER LEVEL			REFERENCES**/ REMARKS
				DEPTH BELOW GROUND SURFACE-FEET (METERS)	DATE MEASURED	ELEVATION-FEET (METERS) ABOVE M. S. L.	
W-1	4S/63E - 23dd	4840 (1475)	61 (19)	DRY	1988	4779 (1457)	1
W-2	4S/63E - 24da	4875 (1486)	360 (110)	DRY	1987	4515 (1376)	1
W-3	7S/64E - 21dd	5820 (1775)	90 (27)	63 (19)	1984	5757 (1755)	1
W-4	7S/64E - 19	4779 (1464)	265 (81)	220 (67)	1988	4560 (1387)	1
WR-T1	6S/63E - 13adc	4715 (1437)	1195 (364)	860 (262)	3 - 80	3855 (1175)	2

*MT. DIABLO BASELINE AND MERIDIAN

**REFERENCES:

1. NEVADA STATE ENGINEERS OFFICE, 1989 : 1987
2. FUGRO NATIONAL, INC. 1989 b

GROUND - WATER DATA
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE — BMO

TABLE
II-2-1

FUGRO NATIONAL, INC.

3.0 EXPLANATION OF SEISMIC REFRACTION DATA

Each figure shows seismic wave travel times plotted versus surface distance between the energy source (shot) and the detector (geophone) for a single seismic line. Distances are measured along the line from geophone number 1 which is designated as zero distance. Distances to the right (on the paper) of geophone 1 are positive. The direction arrow gives the approximate direction of the geophone array from geophone 1 to geophone 24.

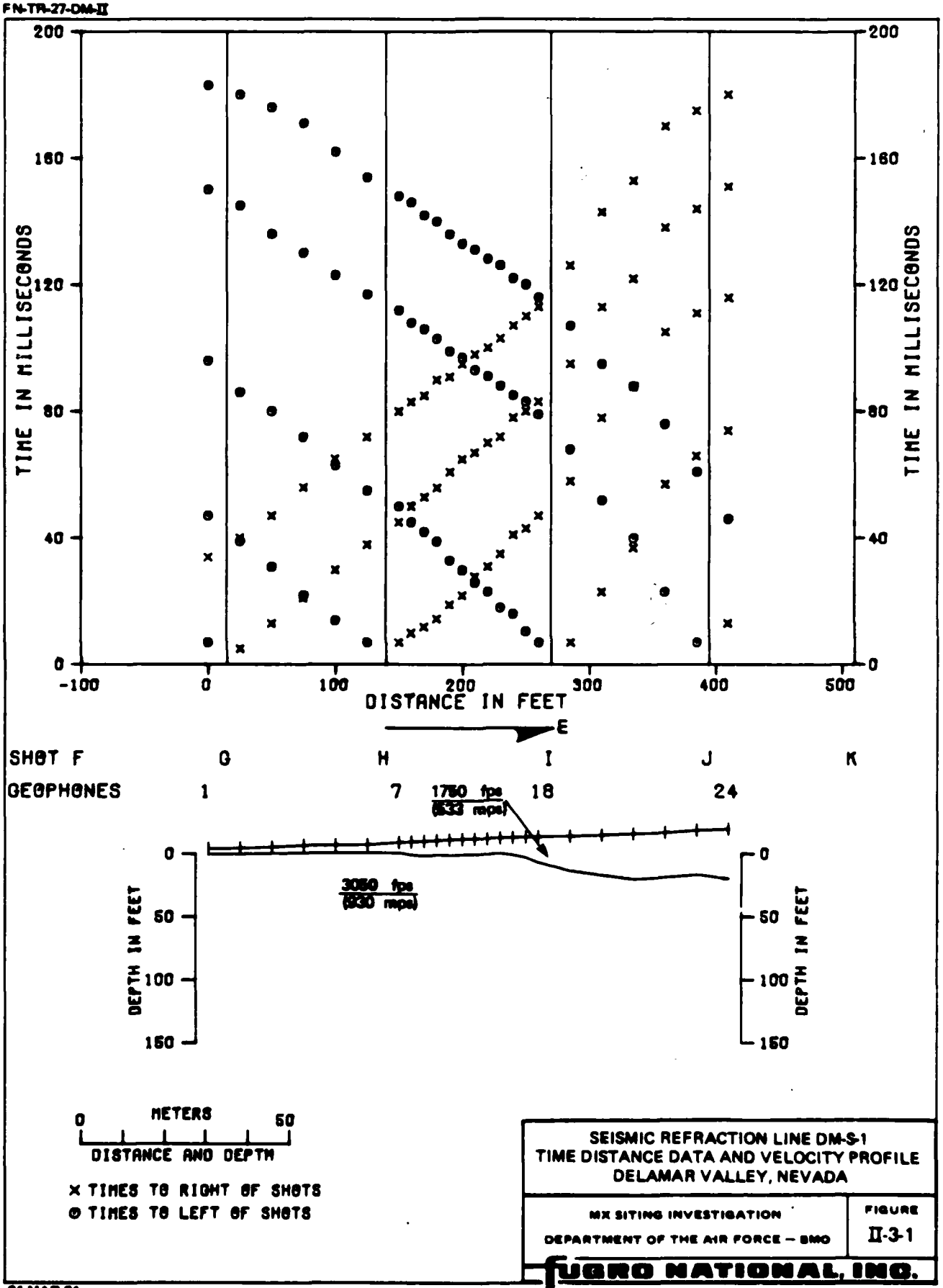
Travel Time Versus Distance Graph (Upper Half of Figure)

On this graph, the abscissa represents distance; the ordinate, time. The six vertical lines represent the locations of shots (designated as F, G, H, I, J, and K). The symbol "X" denotes travel times at geophones that were located to the right of a shot. The symbol, ⊙, denotes travel times that were located to the left of shots.

Velocity Cross Section (Lower Half of Figure)

This is an interpreted velocity cross section beneath the seismic line. The top line represents the ground-surface profile. The short vertical lines crossing the top line mark the geophone positions. The depth scale is plotted relative to a point on the line which was arbitrarily chosen as "zero elevation" at the time the line was surveyed. The additional lines across the cross section represent the interpreted boundaries between layers of material with different compressional wave velocities. These boundaries are commonly called "refractors."

The velocity interpreted to be representative of each layer is shown.

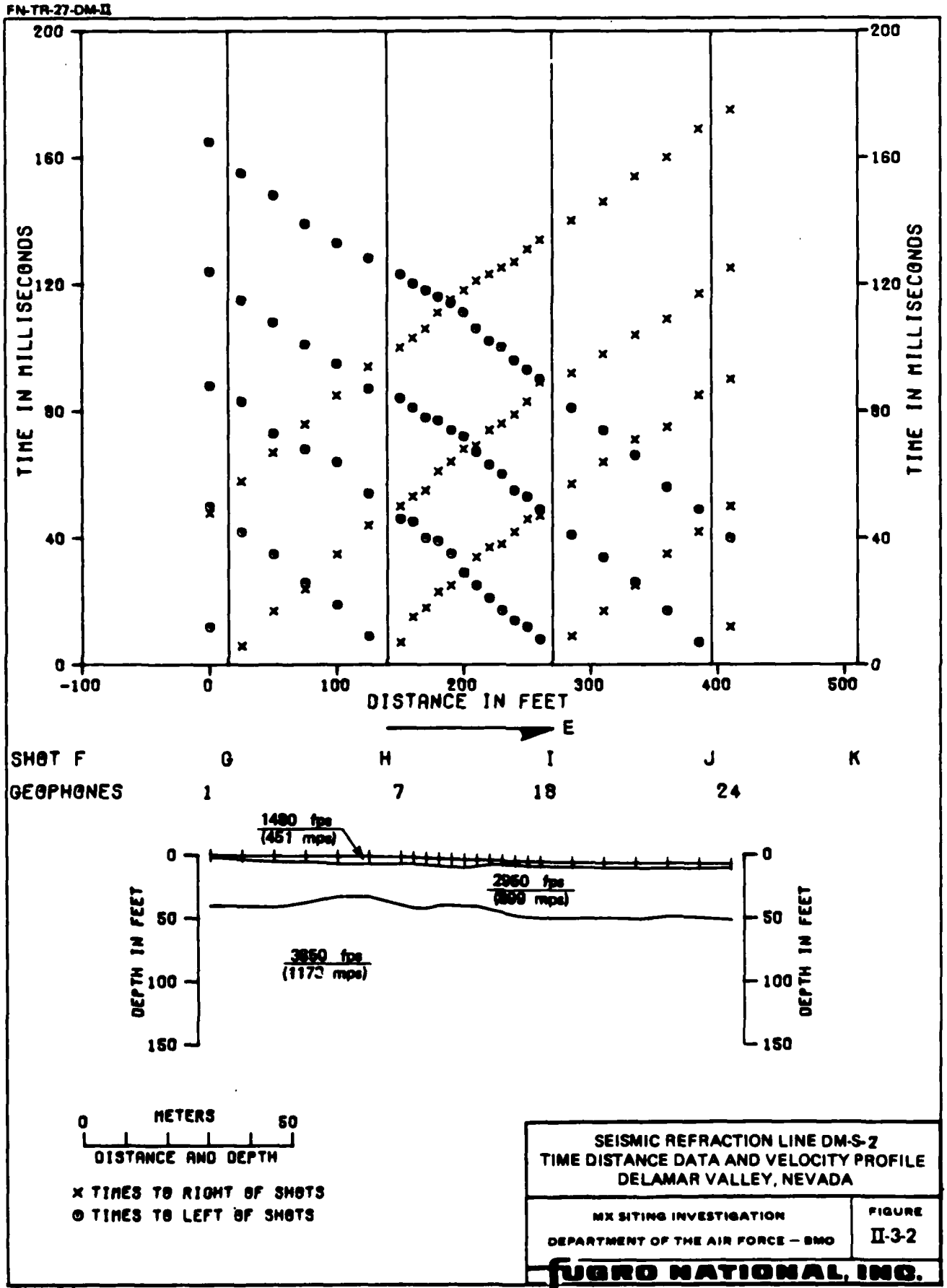


SEISMIC REFRACTION LINE DM-S-1
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-1

FUGRO NATIONAL, INC.



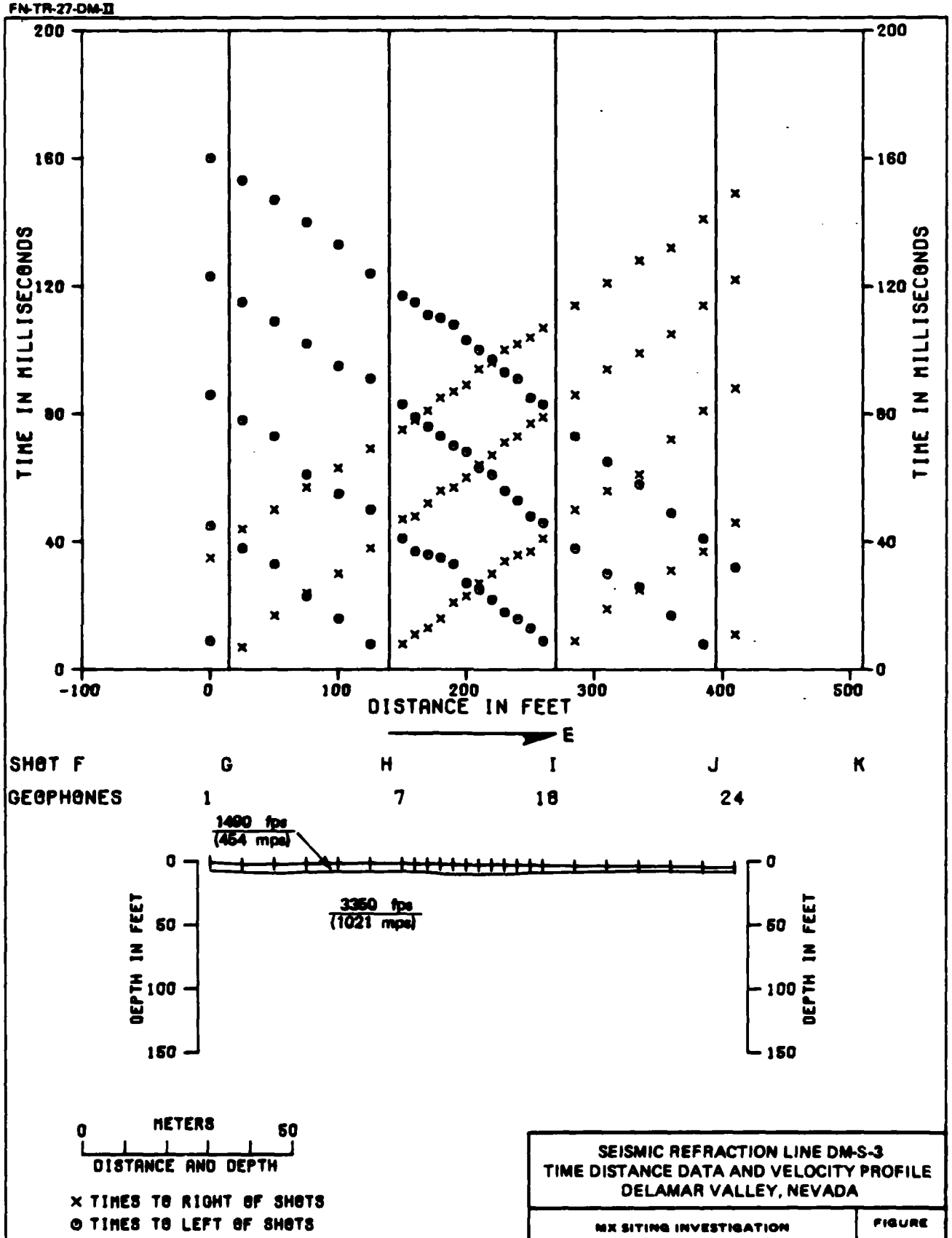
SEISMIC REFRACTION LINE DM-S-2
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-2

FUGRO NATIONAL, INC.

24 MAR 81



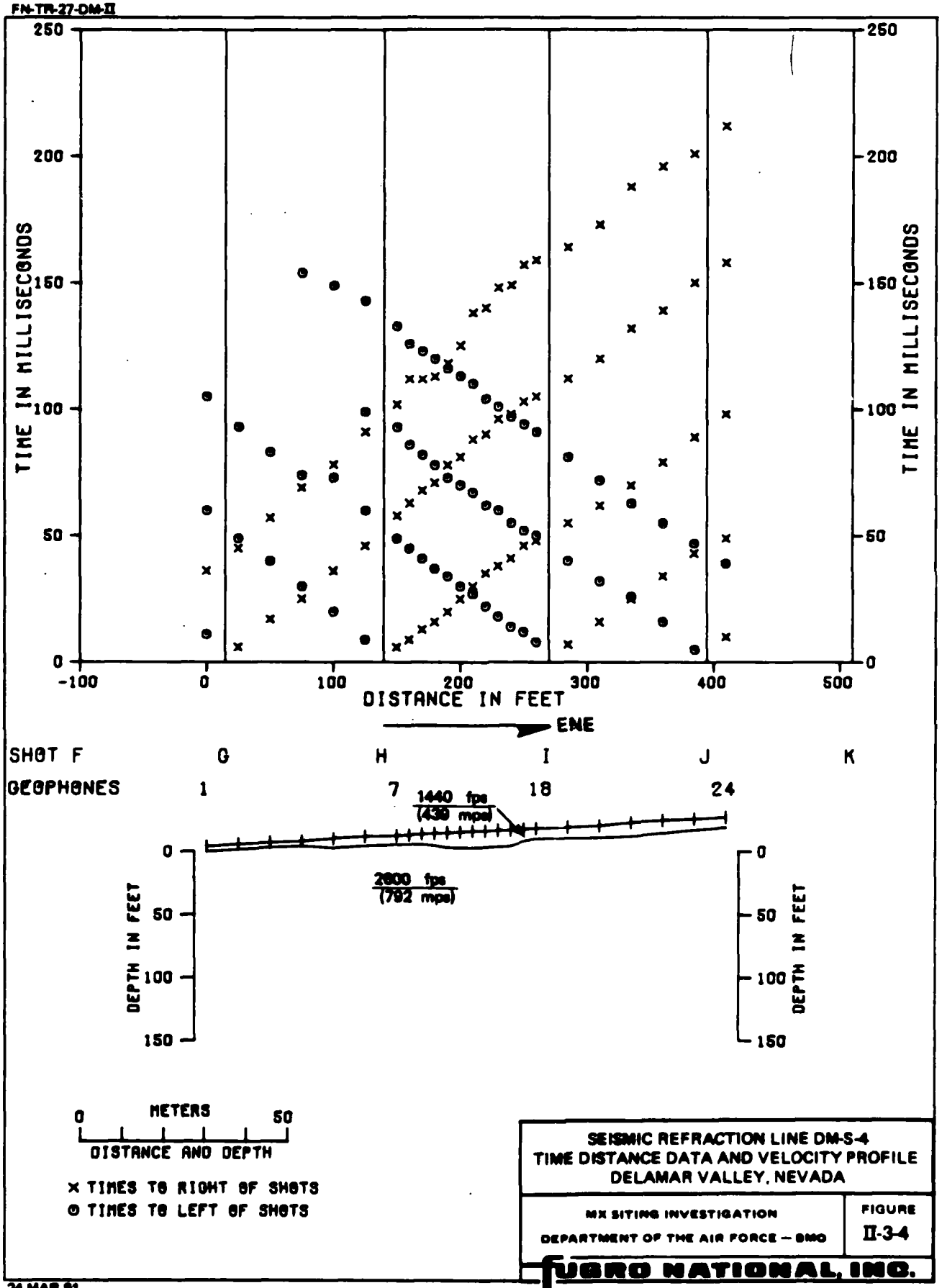
SEISMIC REFRACTION LINE DM-S-3
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-3

FUGRO NATIONAL, INC.

24 MAR 81



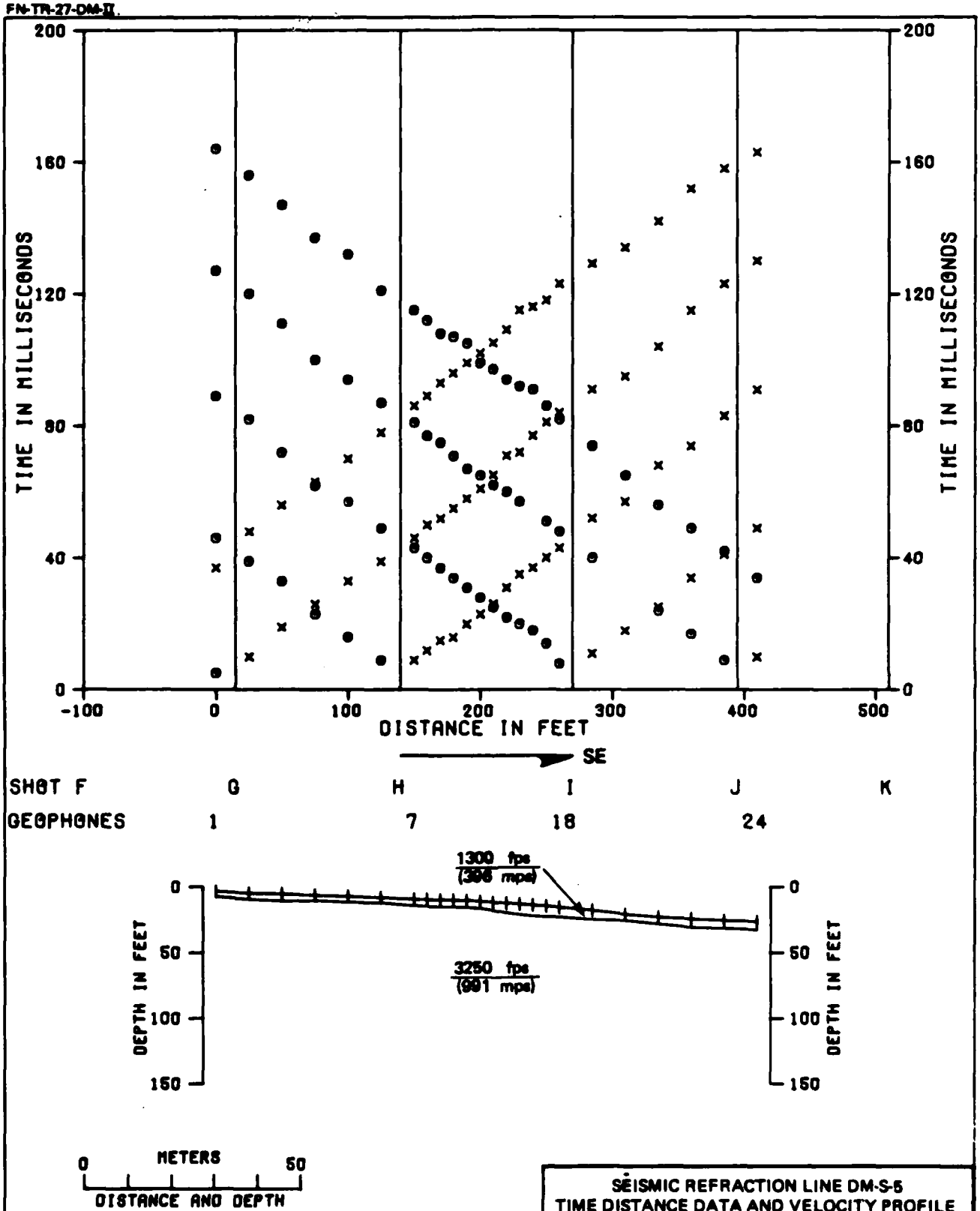
SEISMIC REFRACTION LINE DM-S-4
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-4

FUGRO NATIONAL, INC.

24 MAR 81



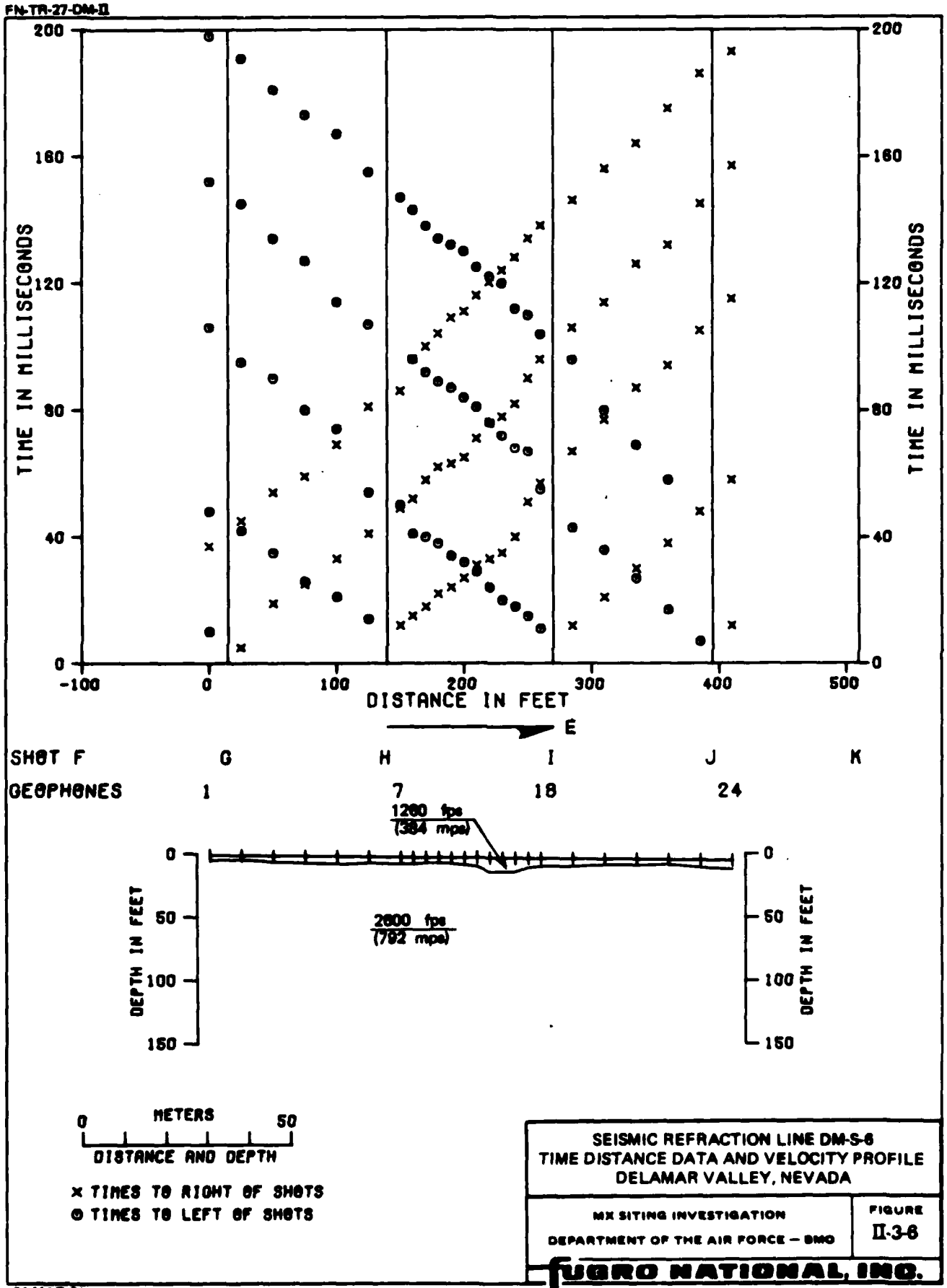
SEISMIC REFRACTION LINE DM-S-5
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-5

FUGRO NATIONAL, INC.

24 MAR 81



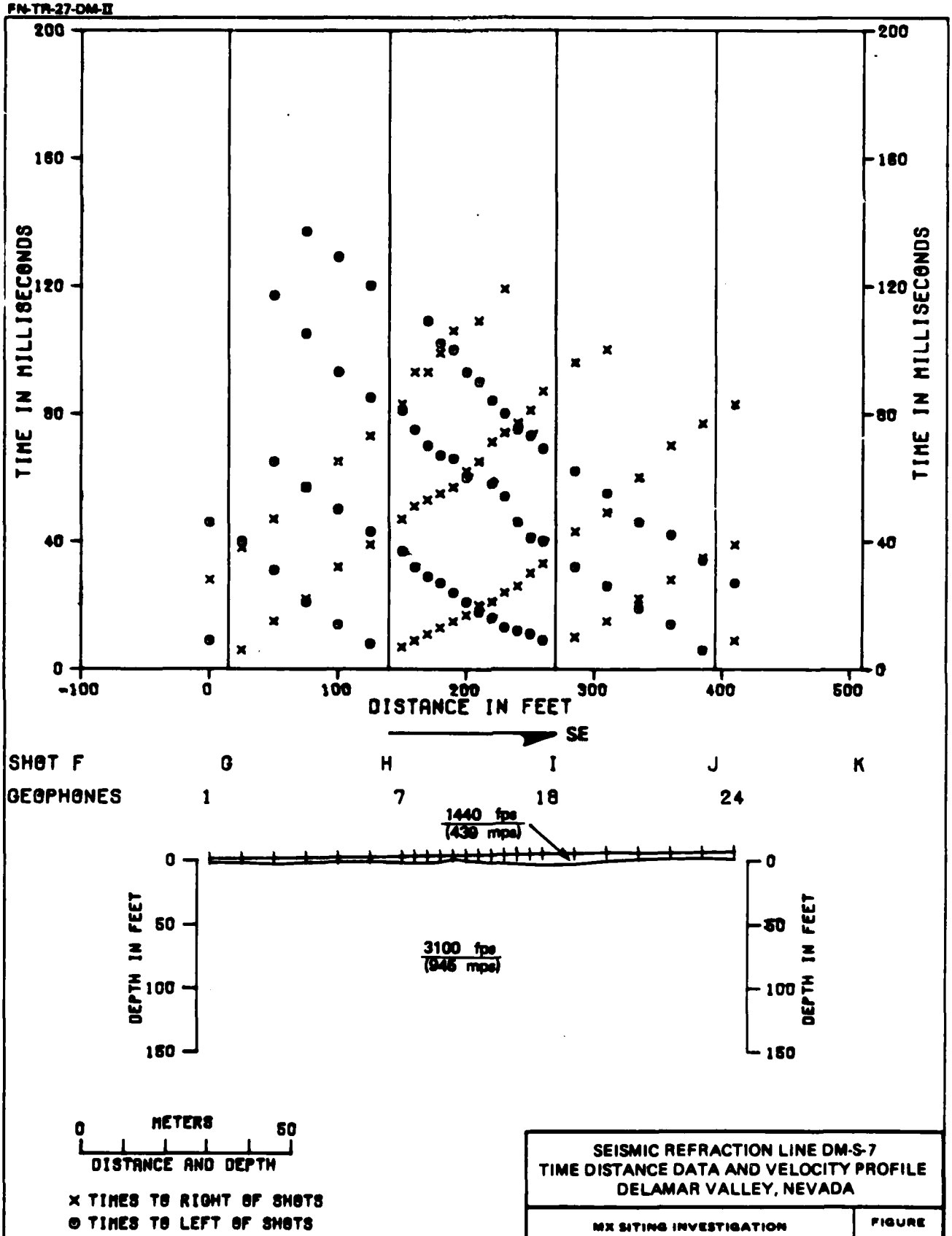
SEISMIC REFRACTION LINE DM-S-6
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-6

FUGRO NATIONAL, INC.

24 MAR 81

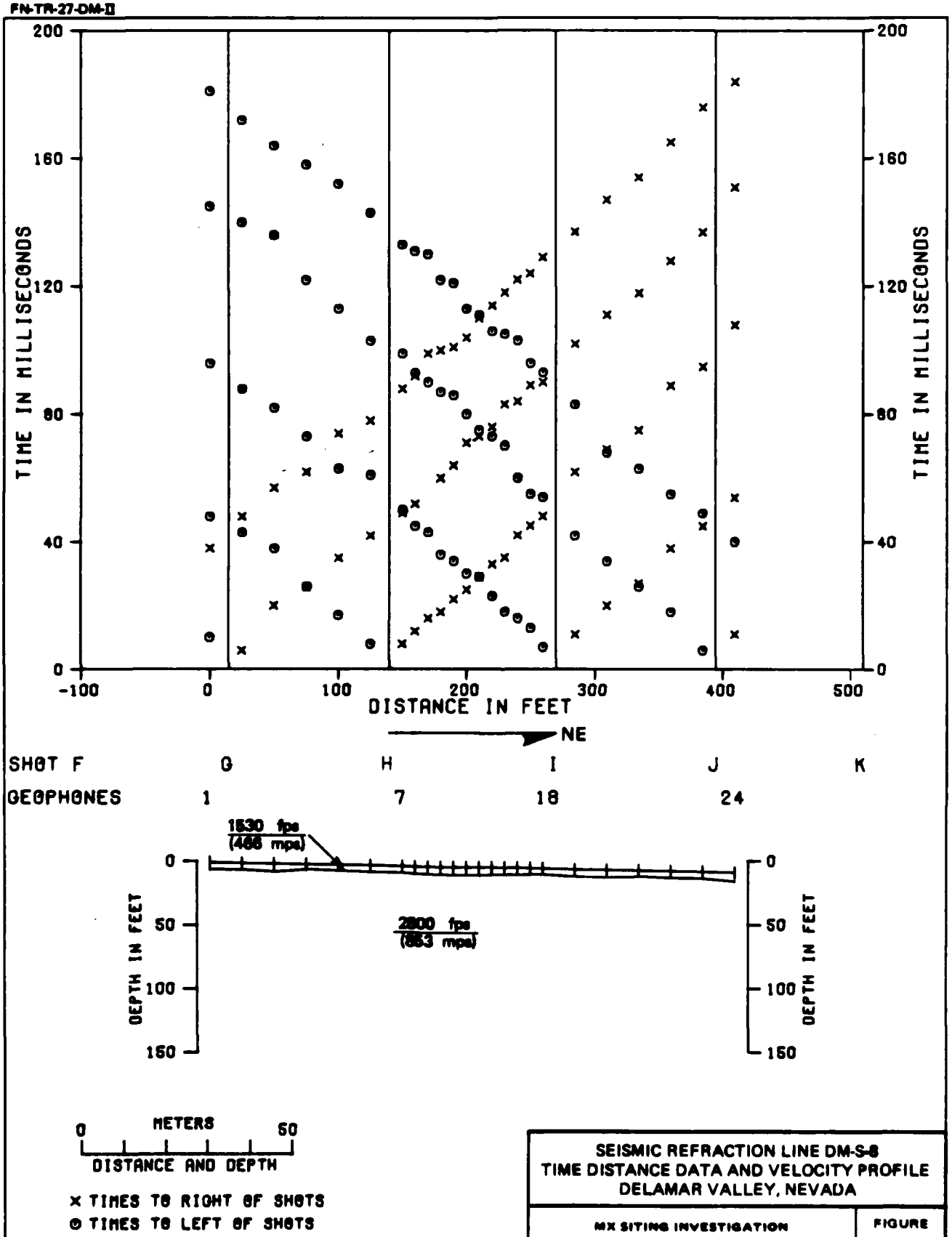


SEISMIC REFRACTION LINE DM-S-7
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-7

FUGRO NATIONAL, INC.

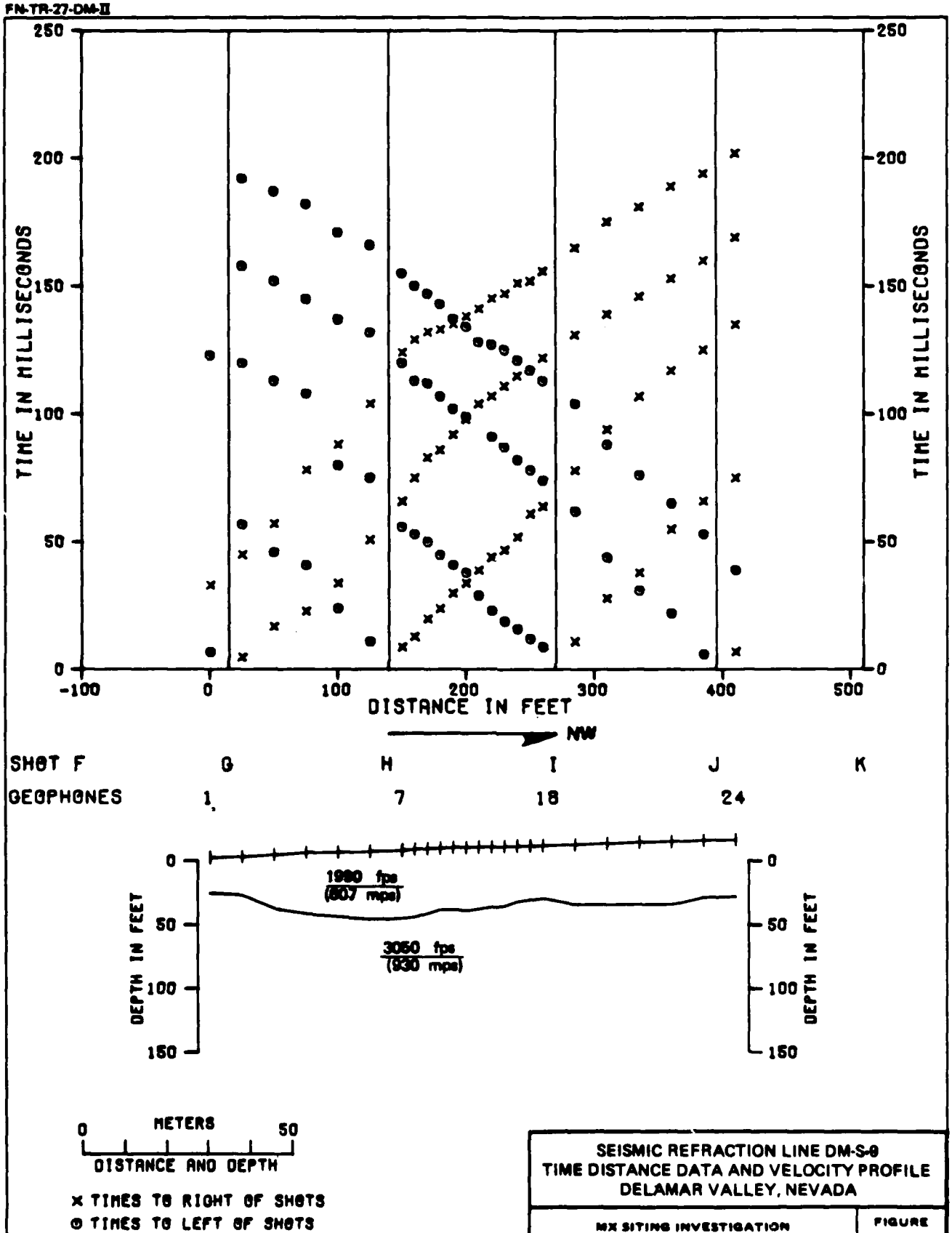


SEISMIC REFRACTION LINE DM-S-8
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE II-3-8

FUGRO NATIONAL, INC.



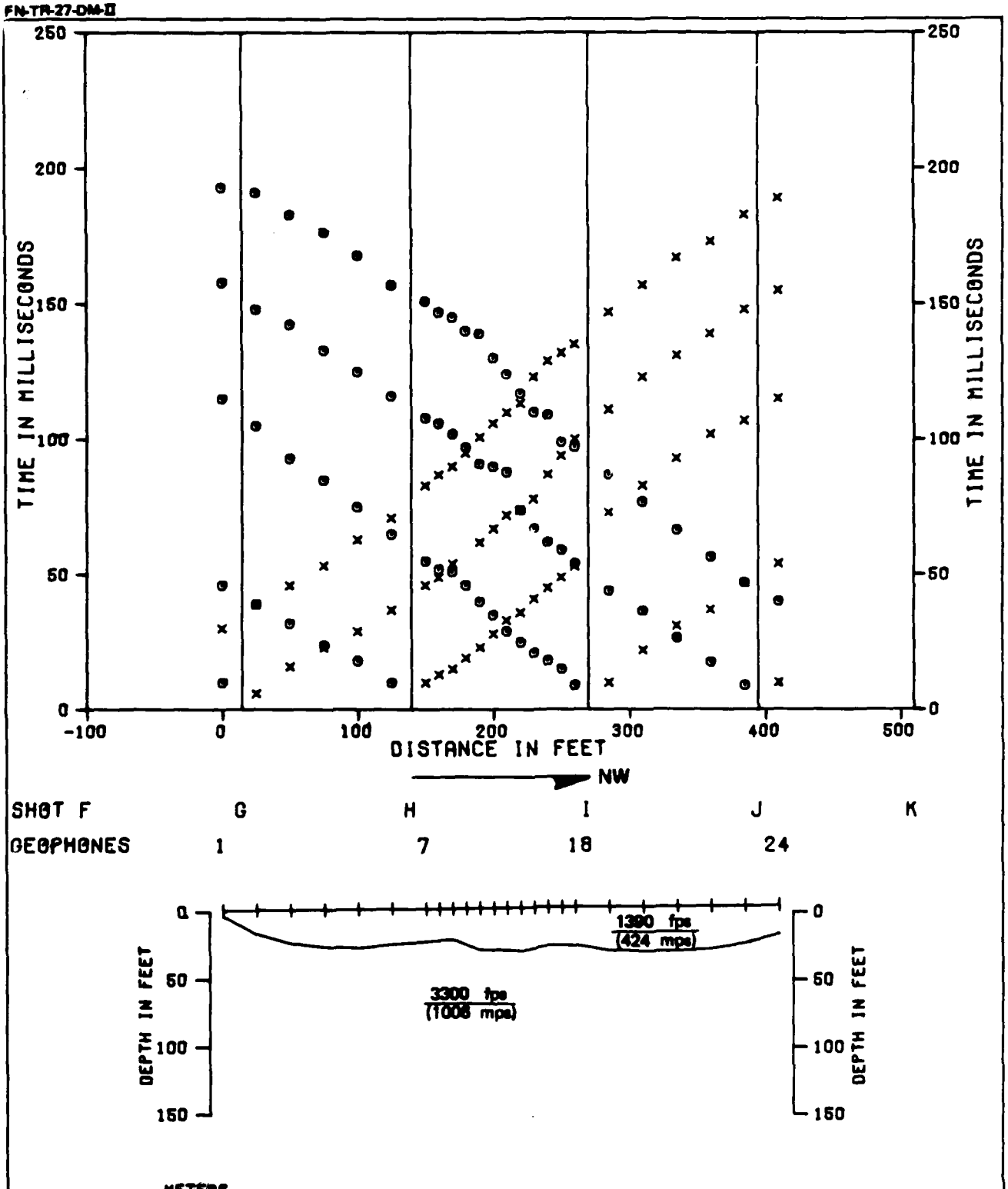
SEISMIC REFRACTION LINE DM-S-9
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE — BMO

FIGURE
II-3-9

FUGRO NATIONAL, INC.

24 MAR 81

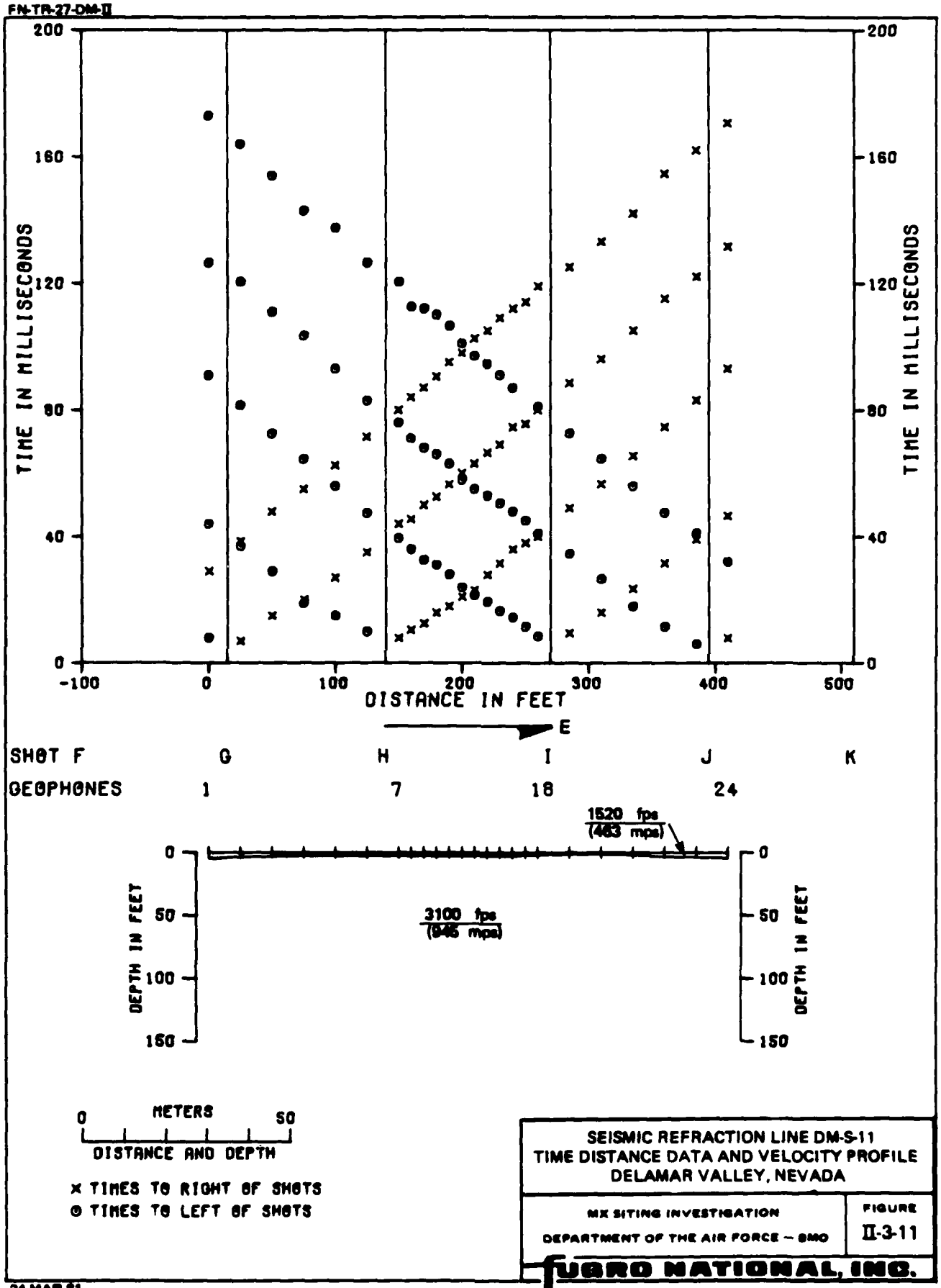


SEISMIC REFRACTION LINE DM-S-10
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-10

FUGRO NATIONAL, INC.



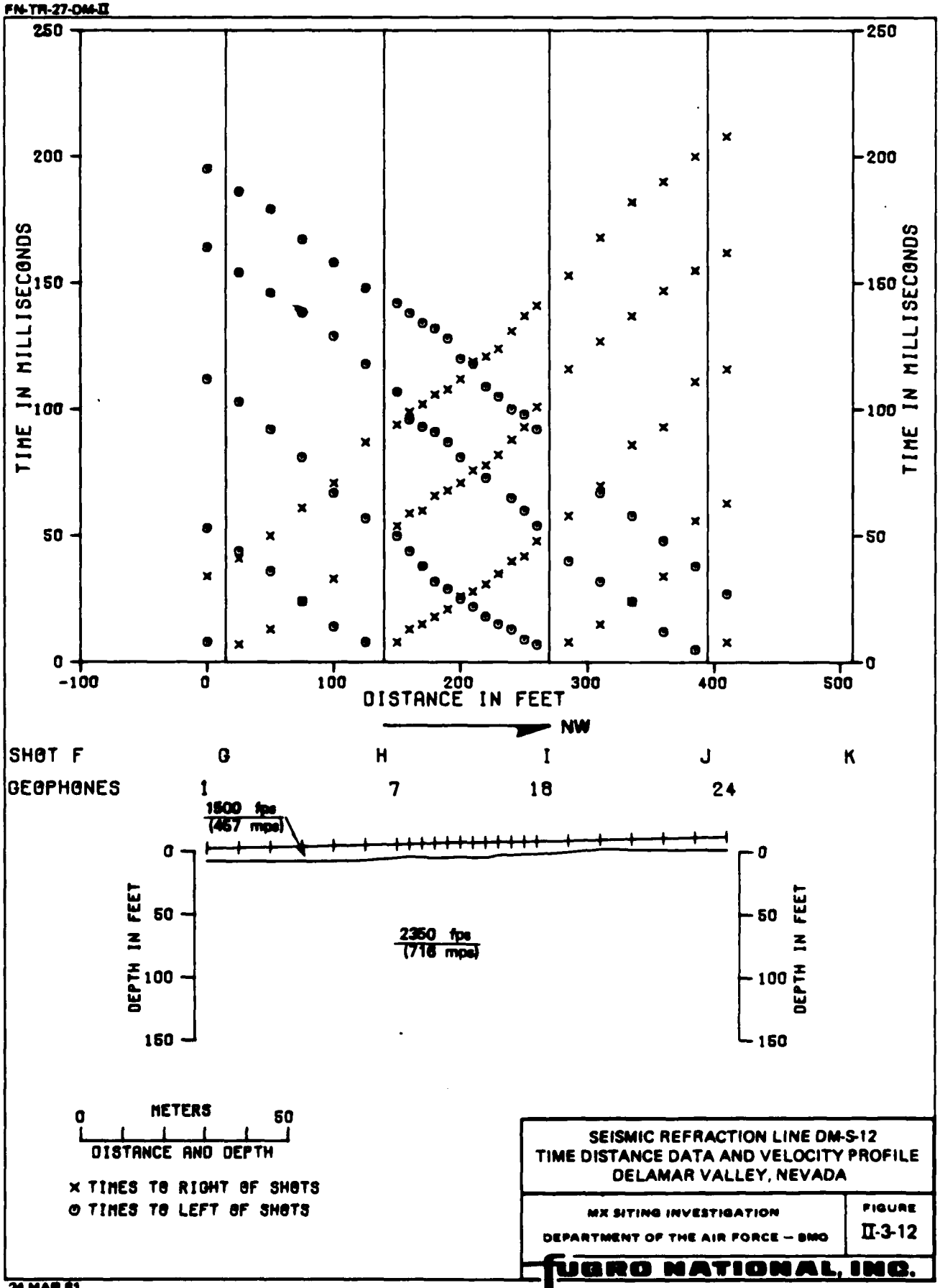
SEISMIC REFRACTION LINE DM-S-11
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-11

FUGRO NATIONAL, INC.

24 MAR 81

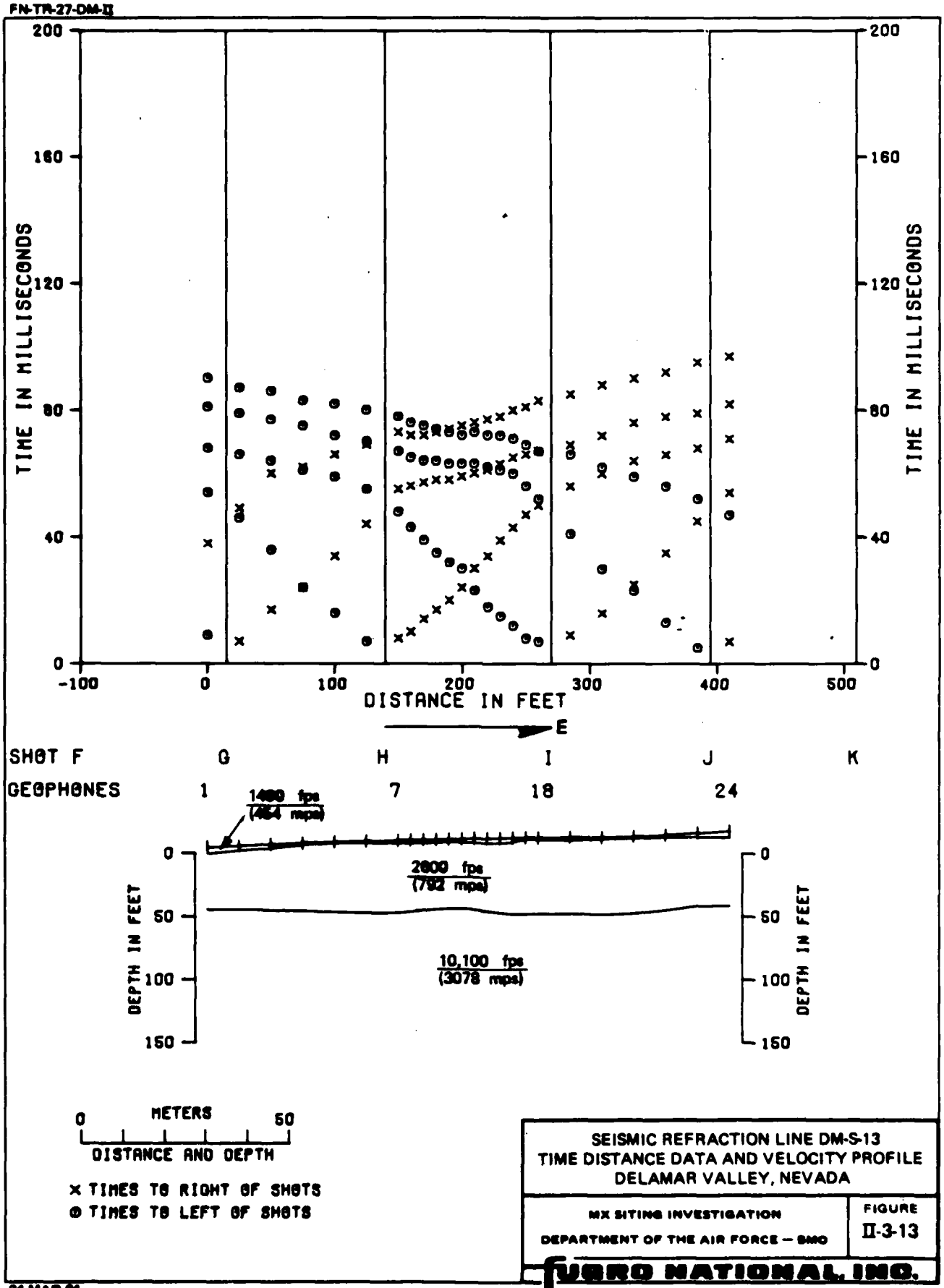


SEISMIC REFRACTION LINE DM-S-12
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE – BMO

FIGURE
II-3-12

FUGRO NATIONAL, INC.



SEISMIC REFRACTION LINE DM-S-13
TIME DISTANCE DATA AND VELOCITY PROFILE
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE — BMO

FIGURE
II-3-13

FUGRO NATIONAL, INC.

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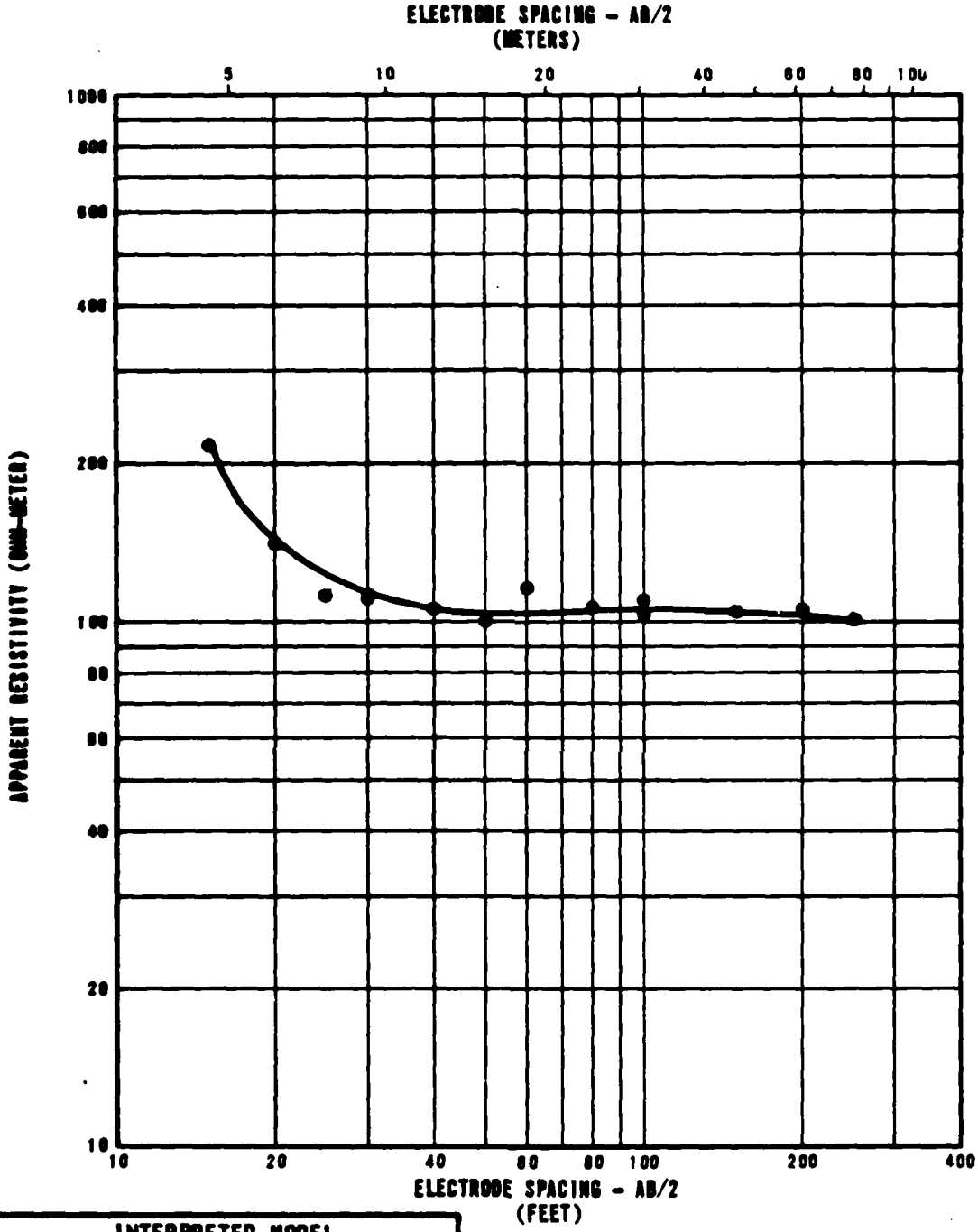
4.0 EXPLANATION OF ELECTRICAL RESISTIVITY DATA

Each figure in this section presents the data obtained from a resistivity sounding and a tabulated model of resistivity layers that would produce a curve similar to the observed curve.

The upper portion of the figures is a graph in which measured apparent resistivity values in ohm-meters are plotted versus one-half the distance between the current electrodes.

The interpreted model tabulated at the bottom of the page shows a combination of true resistivity layers and thicknesses obtained by matching theoretical curves to the field curve.

Note: There was no resistivity sounding at location DM-SR-11 because of electrical interference from a grounded fence.



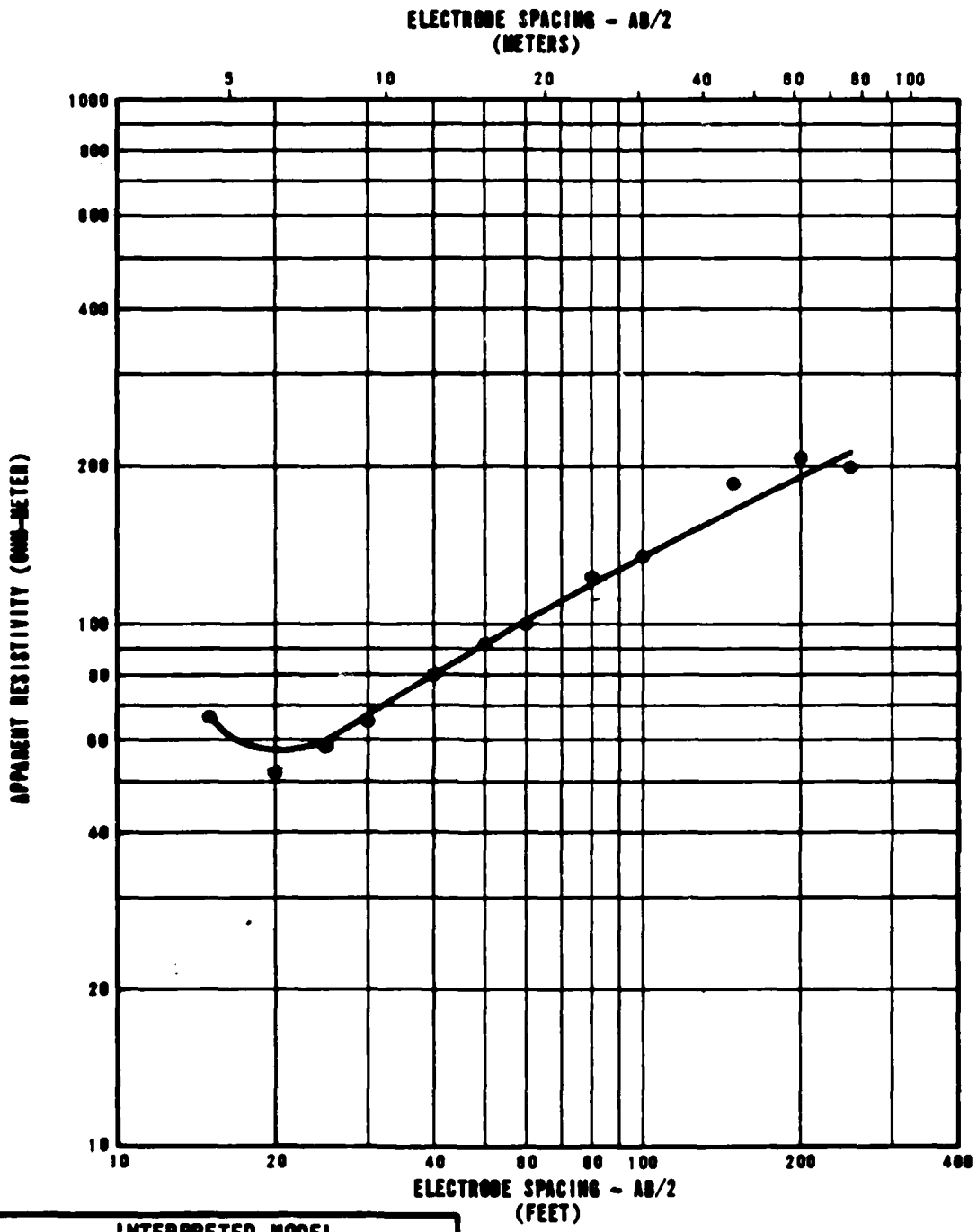
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	470
5	2	100

RESISTIVITY SOUNDING DM-R-1
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - [illegible]

FIGURE
II-4-1

FUGRO NATIONAL, INC.



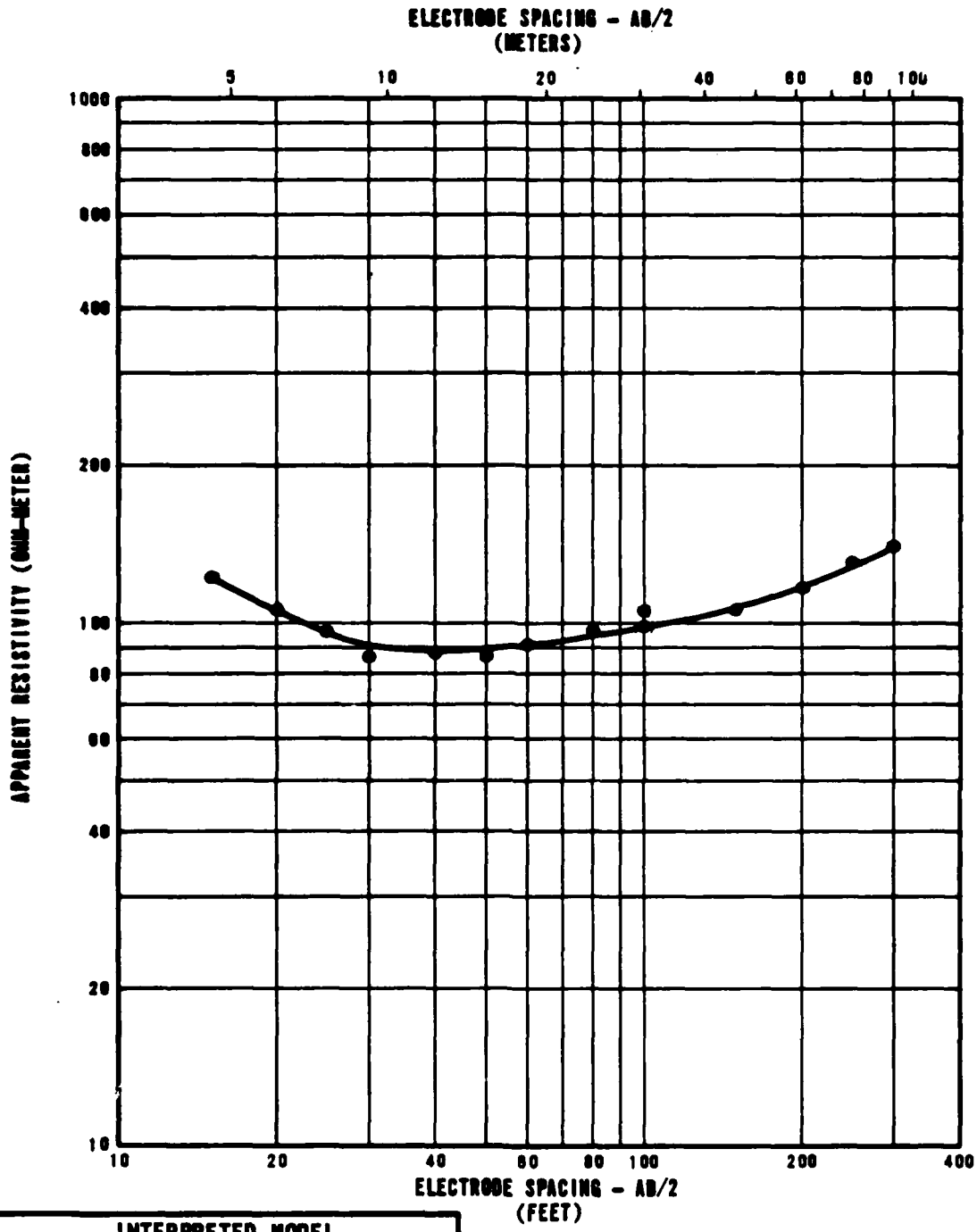
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	120
5	2	30
18	5	280

RESISTIVITY SOUNDING DM-R-2
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-2

FUGRO NATIONAL, INC.



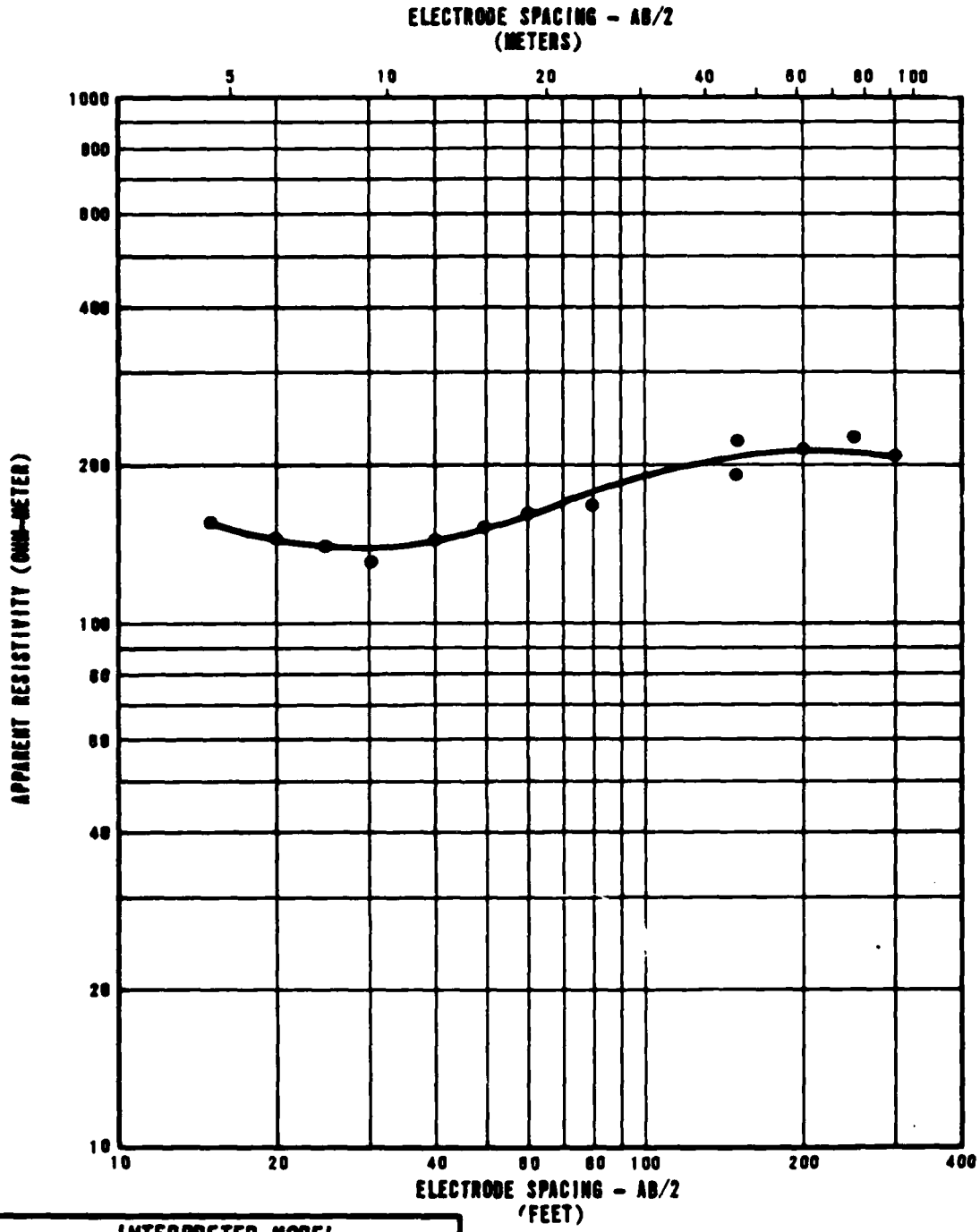
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	160
5	2	90
146	45	280

RESISTIVITY SOUNDING DM-R-3
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-3

FUGRO NATIONAL, INC.



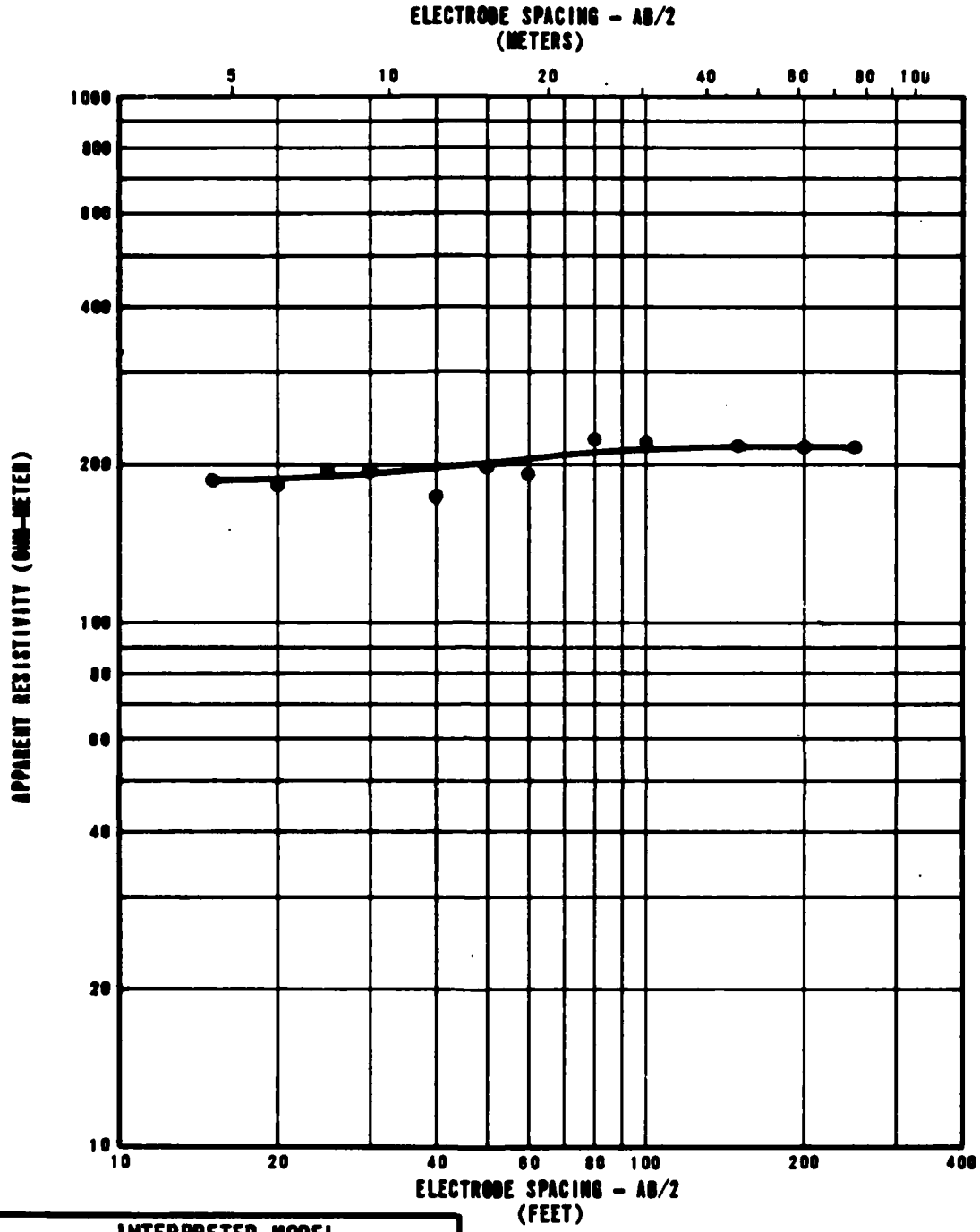
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	170
8	2	120
31	9	260
141	43	160

RESISTIVITY SOUNDING DM-R-4
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-4

FUGRO NATIONAL, INC.



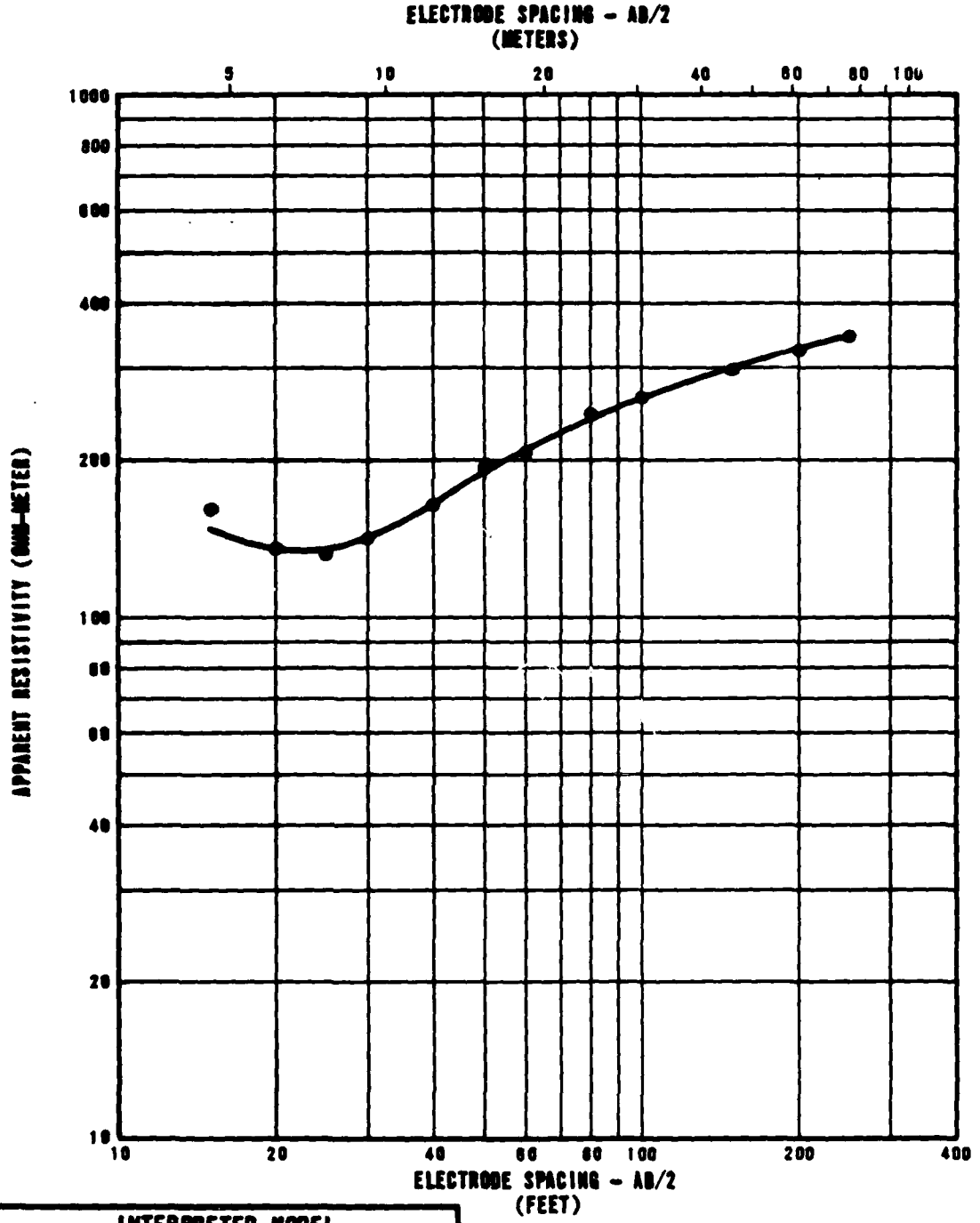
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	190
55	17	230

RESISTIVITY SOUNDING DM-R-5
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-5

FUGRO NATIONAL, INC.



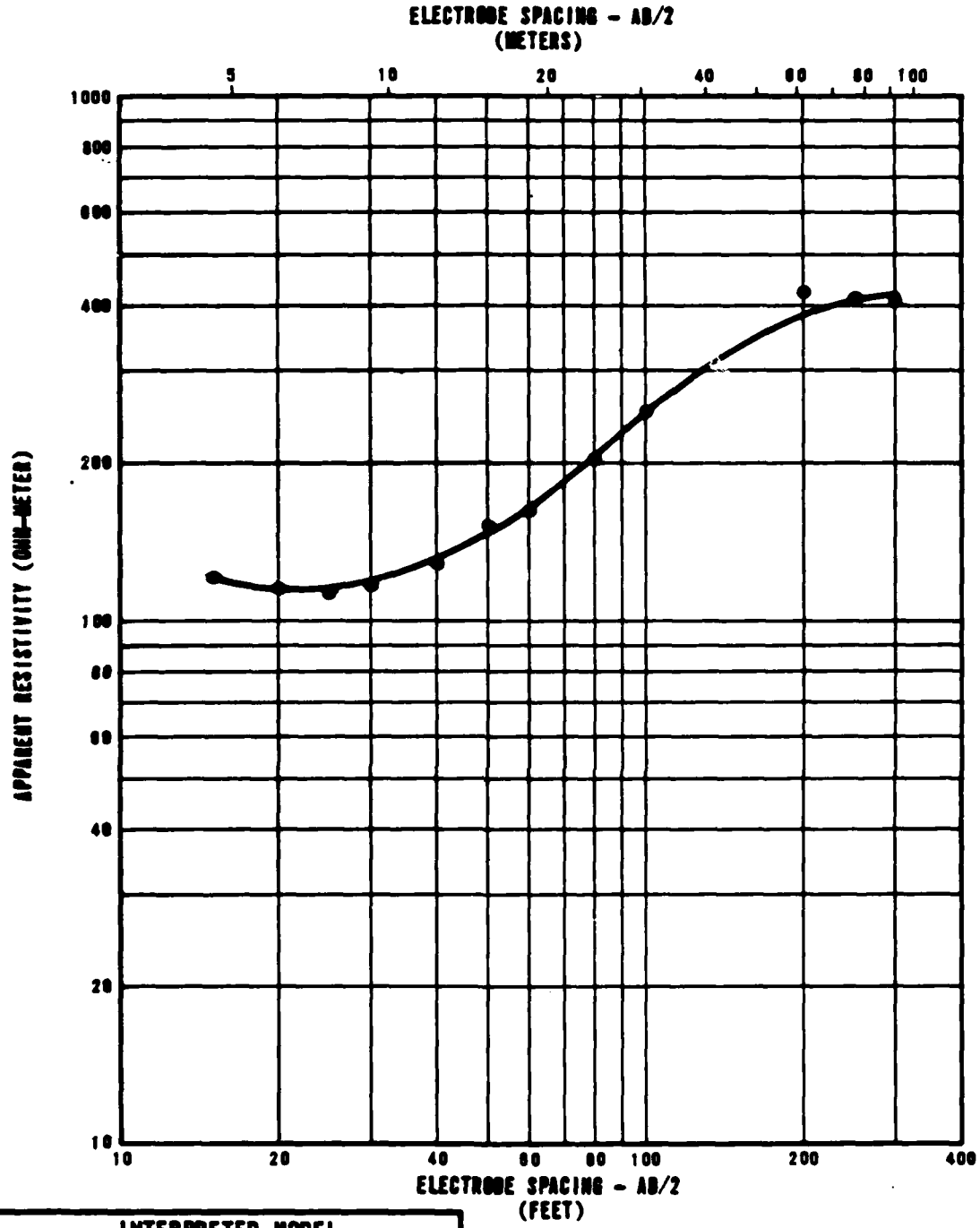
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	200
6	2	110
26	8	380

RESISTIVITY SOUNDING DM-R-6.
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-6

FUGRO NATIONAL, INC.



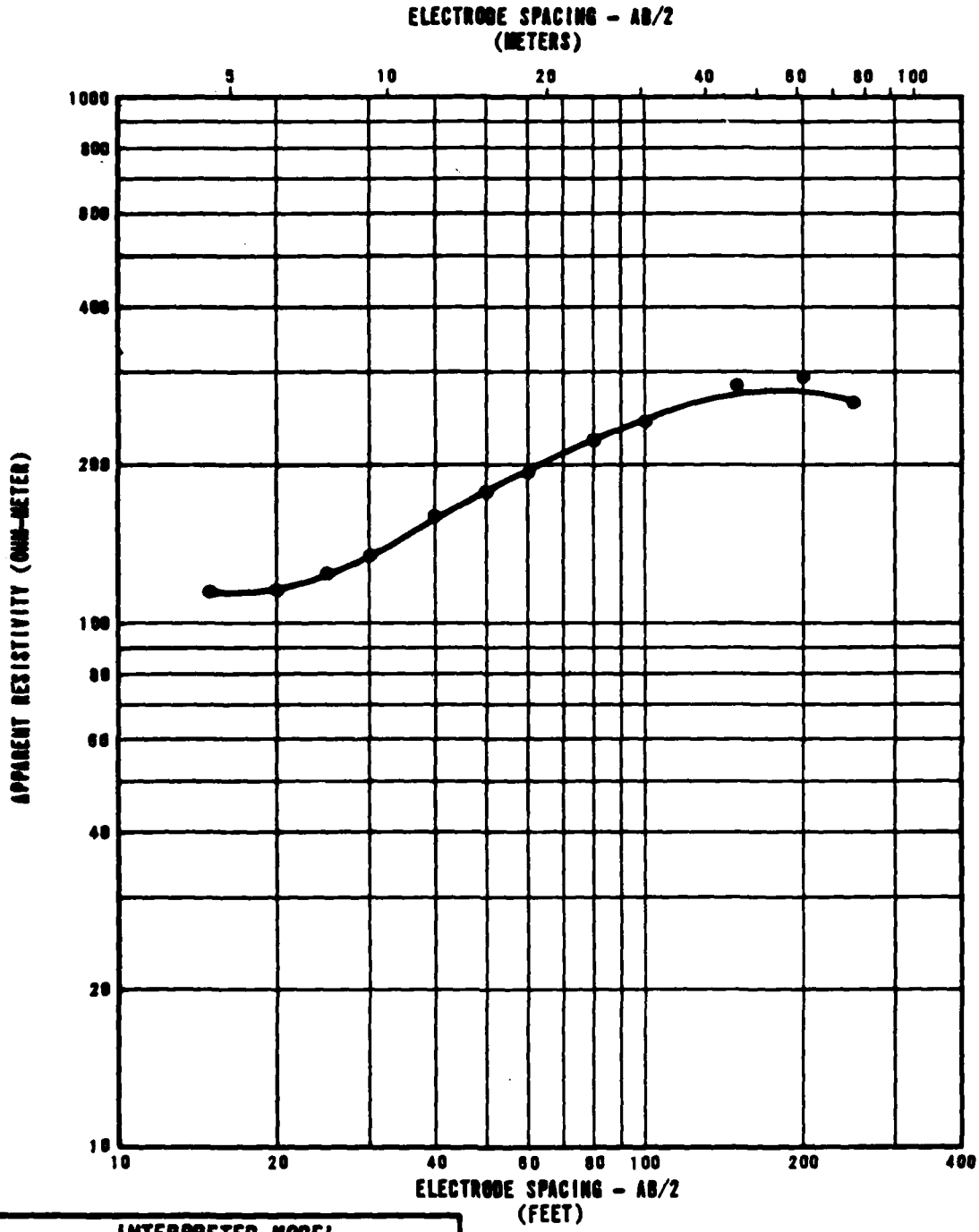
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	120
11	3	95
32	10	780
180	55	380

RESISTIVITY SOUNDING DM-R-7
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-7

FUGRO NATIONAL, INC.



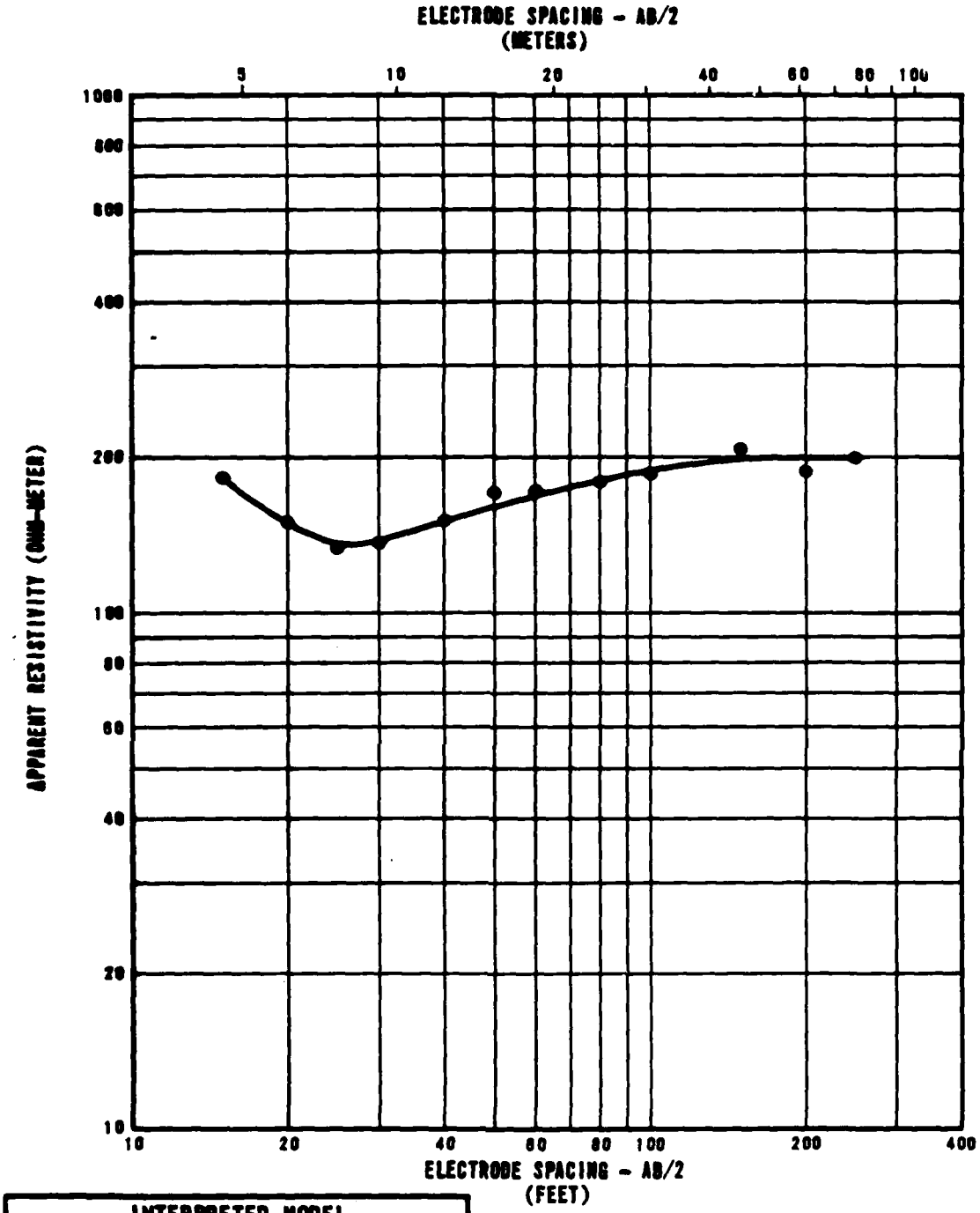
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	~ 120
20	6	370
150	46	120

RESISTIVITY SOUNDING DM-R-8
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-8

FUGRO NATIONAL, INC.



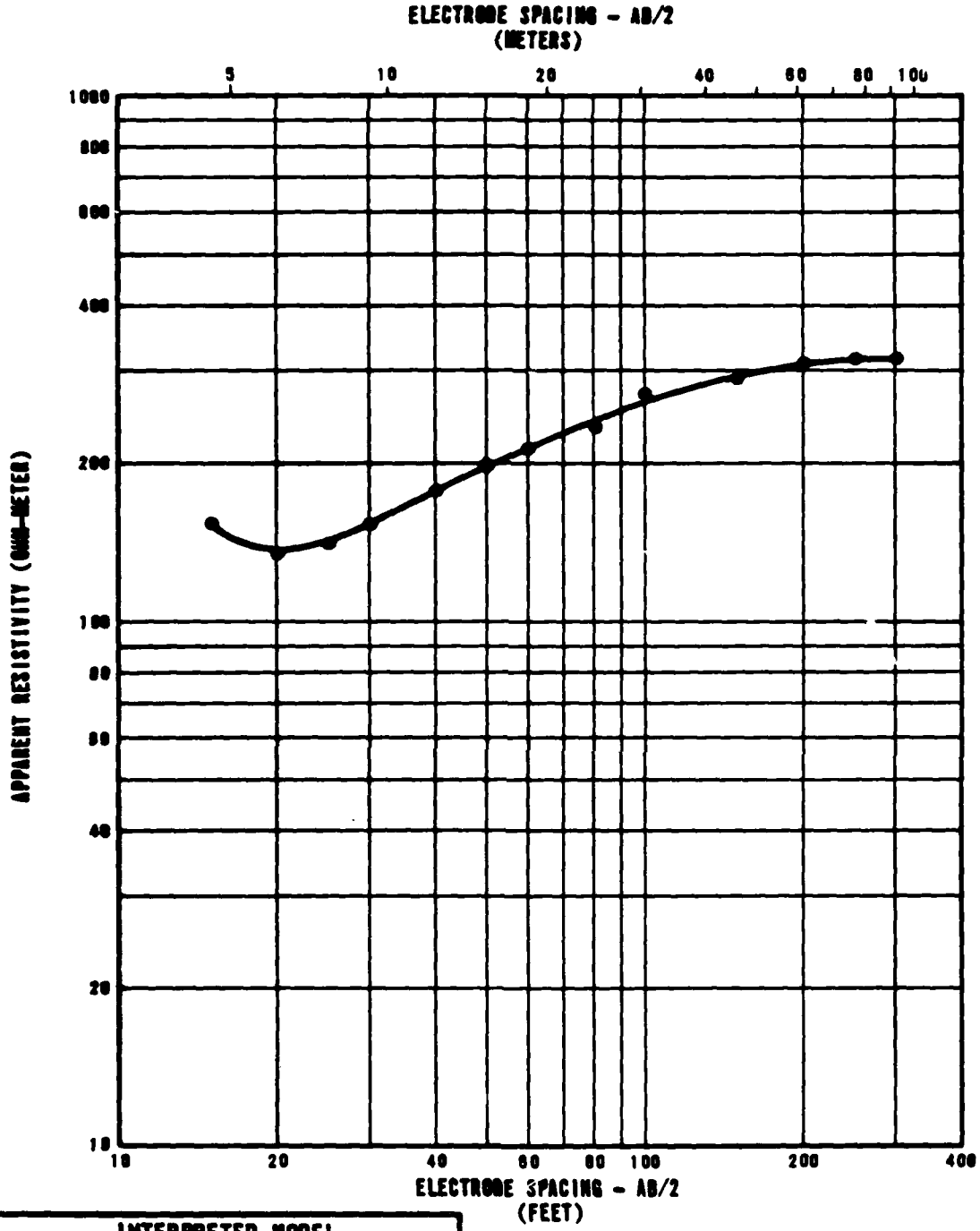
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	270
6	2	110
24	7	620
28	9	200

RESISTIVITY SOUNDING DM-R-9
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-9

FUGRO NATIONAL, INC.



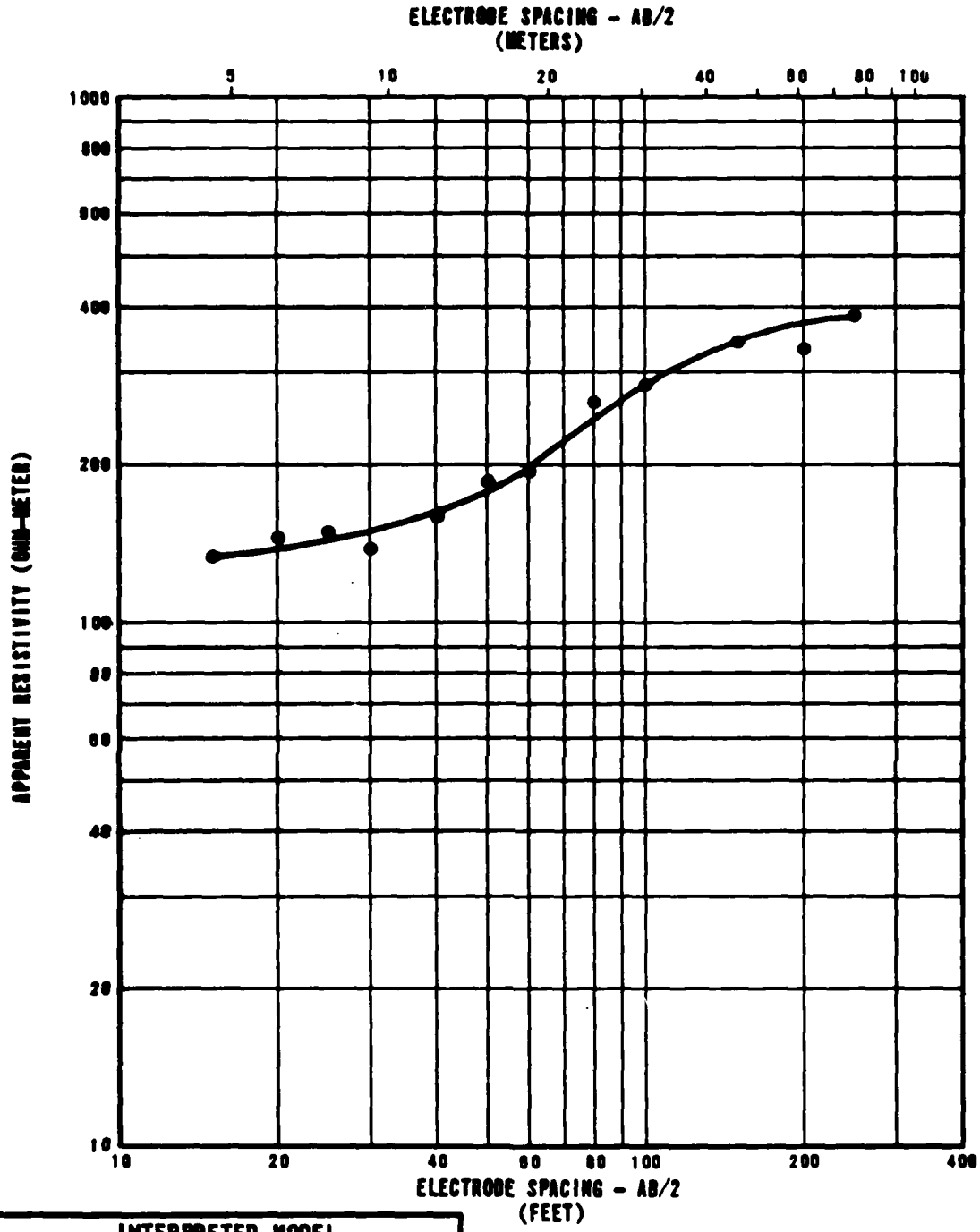
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	190
5	2	120
22	7	640
37	11	300

RESISTIVITY SOUNDING DM-R-10
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-10

FUGRO NATIONAL, INC.



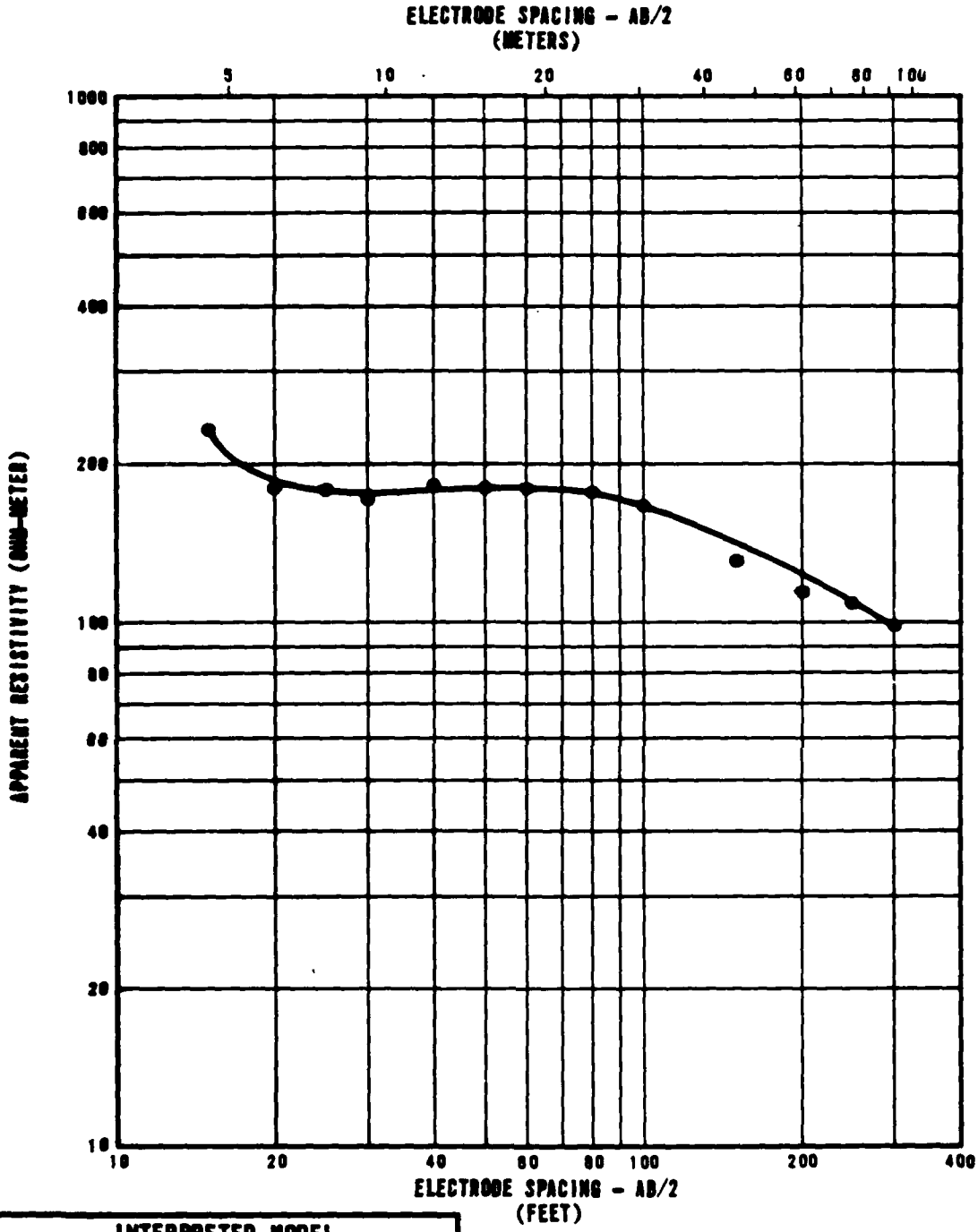
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	130
27	8	400

RESISTIVITY SOUNDING DM-R-12
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-11

FUGRO NATIONAL, INC.



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	360
5	2	160
26	8	310
42	13	110
122	37	80

RESISTIVITY SOUNDING DM-R-13
SOUNDING CURVE AND INTERPRETATION
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-4-12

FUGRO NATIONAL, INC.

5.0 EXPLANATION OF BORING, TRENCH, AND TEST PIT LOGS

All data from borings and trenches are presented on standard Fugro National logs in Sections 5.0 and 6.0. Explanations of the column headings on the logs are as follows:

A. Designations - Borings and trenches are identified as follows:

DM-B-1
DM - abbreviation for the site (e.g., DM-Delamar)
B - abbreviation for activity (e.g., B-boring, T-trench, P-test pit)
1 - number of activity

B. Sample Type - Different sampling techniques were used and the symbols are explained at the bottom of the boring logs. For details of sampling techniques, see Section A5.0 of Appendix in Volume I (FN-TR-27-DM-I). Horizontal lines, to scale, indicate the depth where sampling was attempted.

C. Percent Recovery - The numbers shown represent the ratio (in percent) of the soil sample recovered in the sampler to the full penetration of the sampler.

D. N Value - Corresponds to standard penetration resistance, which is number of blows required to drive a standard split-spoon sampler for the second and third of three 6-inch (15-cm) increments with a 140-pound (63.5 kg) hammer falling 30 inches (76 cm) (ASTM D 1586-67).

E. Depth - Corresponds to depth below ground surface in meters and feet.

F. Lithology - Graphic representation of the soil and rock types.

G. USCS - Unified Soil Classification System symbols (see Table II-5-1 for complete details).

H. Soil Description - Except in cases where samples were classified based on laboratory test data, the descriptions are based on visual classification. The procedures outlined in ASTM D 2487-69, Classification of Soils for Engineering Purposes, and D 2488-69, Description of Soils (Visual-Manual Procedure), were followed. Solid lines across the column indicate known change in strata at the depth shown.

Definitions of some of the terms and criteria to describe soils and conditions encountered during the exploration follow.

Gradation : A coarse-grained soil is well graded if it has a wide range in grain size and substantial amounts of most intermediate particle sizes.

Poorly graded indicates that the soil consists predominantly of one size (uniformly graded) or has a wide range of sizes with some intermediate sizes obviously missing (gap-graded).

Moisture :

Dry	- no feel of moisture
Slightly Moist	- much less than normal moisture
Moist	- normal moisture for soil
Very Moist	- much greater than normal moisture
Wet	- for soils below the water table

Consistency: Consistency descriptions of coarse-grained soils (GW, GP, GM, GC, SW, SP, SM, SC) follow.

Consistency	N Value (ASTM D 1586-67)
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Consistency descriptions of fine-grained soils (ML, CL, MH, CH) are as follows:

Consistency	Shear Strength (ksf)	Shear Strength (kn/m^2)	Field Guide
Very Soft	0.25	12	Sample with height equal to twice the diameter, sags under own weight
Soft	0.25-0.50	12 - 24	Can be squeezed between thumb and forefinger
Firm	0.50-1.00	24-48	Can be molded easily with fingers
Stiff	1.00-2.00	48-96	Can be imprinted with slight pressure from fingers
Very Stiff	2.00-4.00	96-192	Can be imprinted with considerable pressure from fingers
Hard	over 4.00	over 192	Cannot be imprinted by fingers

Grain Shape:

Angular - particles have sharp edges and relatively plane sides with unpolished surfaces.

Subangular - particles are similar to angular but have somewhat rounded edges.

Subrounded - particles exhibit nearly plane sides but have well-rounded corners and edges.

Rounded - particles have smoothly curved sides and no edges.

Calcareous : Containing calcium carbonate; presence of calcium carbonate is commonly identified on the basis of reaction with dilute hydrochloric acid.

Caliche : Soils cemented by calcium carbonate and/or other soluble minerals by upward-moving solutions.

Degree of Cementation: (Stages of development of caliche profile)

Stage	Gravelly Soils	Nongravelly Soils
I	Thin, discontinuous pebble coatings	Few filaments or faint coatings
II	Continuous pebble coatings, some interpebble fillings	Few to abundant nodules, flakes, filaments
III	Many interpebble fillings	Many nodules and internodular fillings
IV	Laminar horizon overlying plugged horizon	Increasing carbonate impregnation

Secondary Material : Example - Sand with trace to some silt

Trace - 5-12% (by dry weight)
Little - 13-20% (by dry weight)
Some - >20% (by dry weight)

Plasticity : Plasticity index is the range of water content, expressed as a percentage of the weight of the oven-dried soil, through which the soil is plastic. It is defined as the liquid limit minus the plastic limit. Descriptive ranges used on the logs include:

Nonplastic (PI, 0 - 4)
Slightly Plastic (PI, 4 - 15)
Medium Plastic (PI, 15 - 30)
Highly Plastic (PI, >30)

Cobbles and Boulders : A cobble is a rock fragment, usually rounded by weathering or abrasion, with an average diameter ranging between 3 and 12 inches (8 and 30 cm).

A boulder is a rock fragment, usually rounded by weathering or abrasion, with an average diameter of 12 inches (30 cm) or more.

I. Remarks - This column was provided on boring and trench logs for comments regarding drilling difficulty, number and size of cobbles or boulders encountered, loss of drilling fluid in the boring, trench wall stability, and other conditions encountered during drilling and excavations.

J. Dry Density and Moisture Content - The boring logs include a graphical display of laboratory test results for dry density (ASTM D 2937-71) in pounds per cubic foot and kilograms per cubic meter and moisture content (ASTM D 2216-71) in percent from representative samples taken during drilling. The symbols are explained at the bottom of the boring logs.

K. Sieve Analysis - The numbers represent the percentage by dry weight (ASTM D 422-63) of each of the following soil components:

GR - Gravel, rock particles that will pass a 3-inch (76-mm) sieve and are retained on No. 4 (4.75 mm) sieve.

SA - Sand, soil particles passing No. 4 sieve and retained on No. 200 (0.075 mm) sieve.

FI - Fines, silt or clay soil particles passing No. 200 sieve.

L. Atterberg Limits (LL and PI) -

LL - Liquid Limit, the water content corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

M. Miscellaneous Information -

Elevations - indicated elevations on the logs are estimated from topographic maps of the study area, within an accuracy of half the contour interval.

Surficial Geologic Unit - indicates the surficial geologic unit in which the activity is located.

Date Drilled - indicates the period from beginning to completion of the activity.

Drilling Method - signifies the type of drilling procedure used such as rotary wash.

Hole Diameter - nominal size of boring drilled.

Water Level - indicates depth from ground surface to water table where encountered.

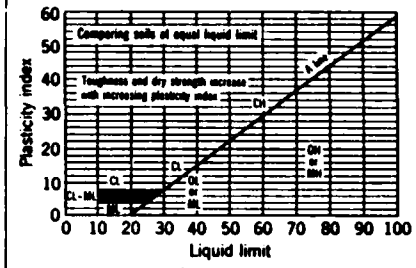
Trench Length - length at ground surface of final trench excavation.

Trench Orientation - bearing of longitudinal trench centerline.

Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights)					Group Symbols[a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils More than half of material is *larger* than No. 200 sieve size[b] (The No. 200 sieve size is about the smallest particle visible to naked eye)	**Gravels** More than half of coarse fraction is larger than No. 4 sieve size (For visual classification, the ¼ in. size may be used as equivalent to the No. 4 sieve size)	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes		*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles ½-in. maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing		*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for *GW*
		Gravels with fines (appreciable amounts of fines)	Nonplastic fines (for identification procedures see *ML* below)		*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures		Atterberg limits below "A" line, or *PI* less than 4 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)		*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, with *PI* greater than 7
	Sands More than half of coarse fraction is smaller than No. 4 sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes		*SW*	Well graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing		*SP*	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for *SW*
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)		*SM*	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line or *PI* less than 5 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)		*SC*	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits below "A" line with *PI* greater than 7
Fine-grained soils More than half of material is *smaller* than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to naked eye)	Identification Procedures on Fraction Smaller than No. 40 Sieve Size							
			Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)			
	Silts and clays liquid limit less than 50		None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)
			Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity	
	Silts and clays liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays	
			Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity	
Highly Organic Soils			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils	

Use grain size curve in identifying the fractions as given under field identification

Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse grained soils are classified as follows:
Less than 5% — *GW, GP, SW, SP*
More than 12% — *GM, GC, SM, SC*
5% to 12% — *Borderline cases requiring use of dual symbols*



Plasticity chart
for laboratory classification of fine grained soils

From Wagner, 1957.
[a] *Boundary classifications.* Soils possessing characteristics of two groups are designated by combinations of group symbols. For example *GW-GC*, well graded gravel-sand mixture with clay binder.
[b] All sieve sizes on this chart are U.S. standard.

Field Identification Procedure for Fine Grained Soils or Fractions

These procedures are to be performed on the minus No. 40 sieve size particles, approximately 1/64 in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (Reaction to shaking):
After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.
Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.
Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics):
After removing particles larger than No. 40 sieve size, mould a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.
High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit):
After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size, is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eight inch in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.
After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.
The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.
Highly organic clays have a very weak and spongy feel at the plastic limit.

UNIFIED SOIL CLASSIFICATION SYSTEM
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

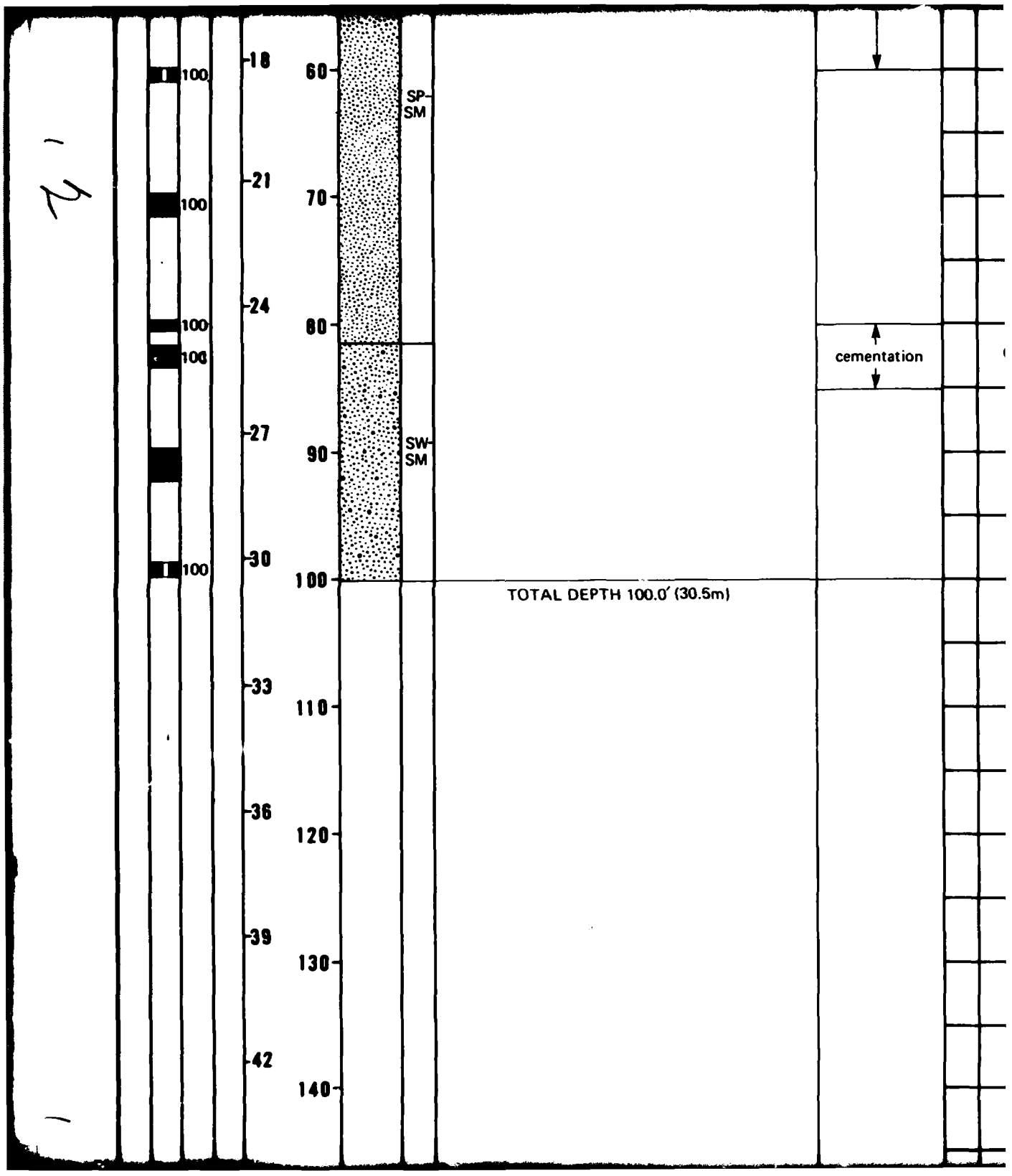
TABLE II-5-1

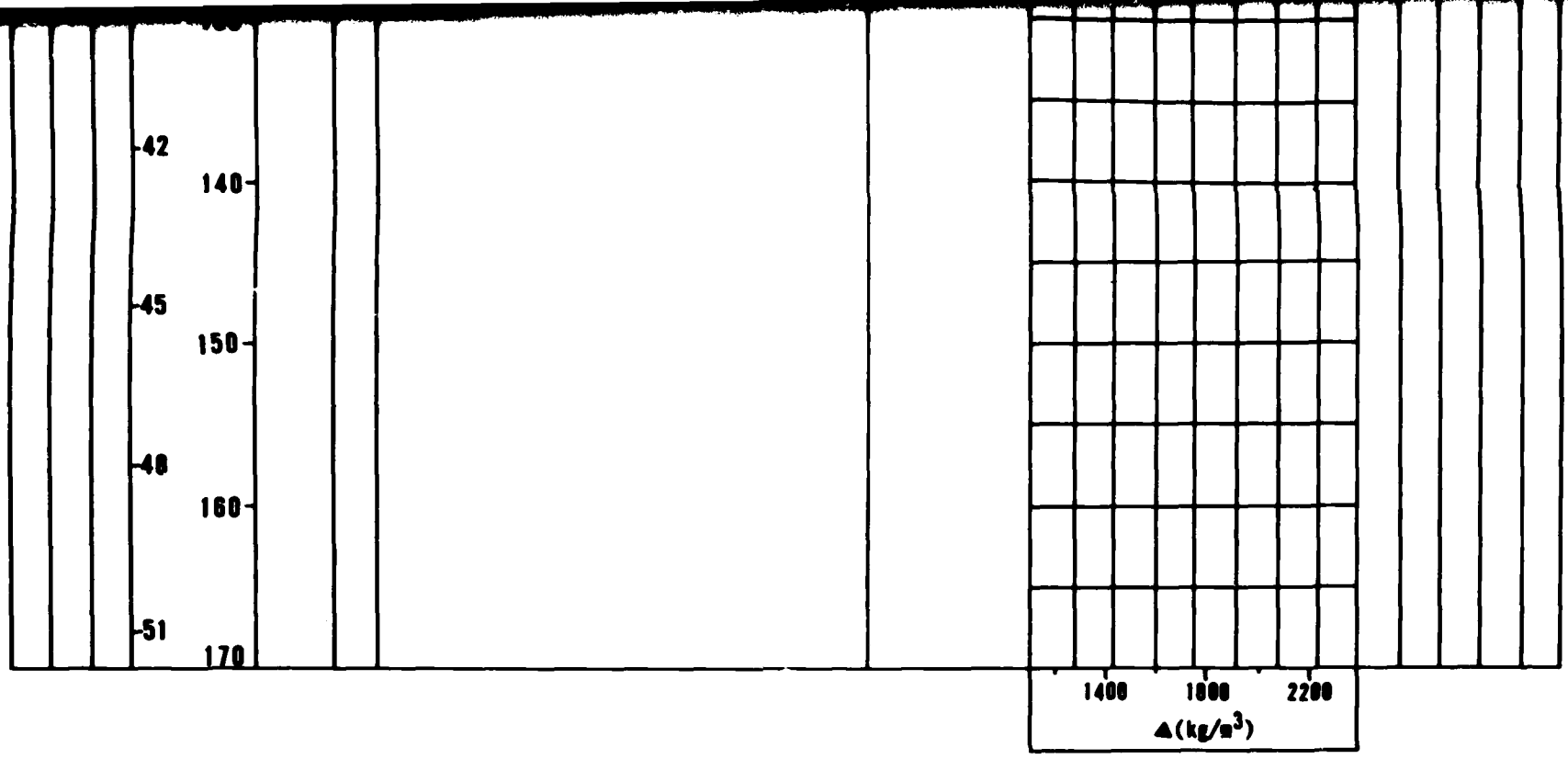
FUGRO NATIONAL, INC.

24 MAR 81

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ● (%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
	100		0	0		SM	SILTY SAND, brown, fine to coarse, poorly graded, dense, angular, calcareous; some nonplastic silt; little fine gravel.			18	48	34		
	100													
	100						GRAVELLY SAND, gray to brown, fine to coarse, well graded, medium dense, subangular; trace to some fine gravel; trace nonplastic silt.			10	85	5		
	100		3	10		SW-SM		cementation		24	67	9		
	100									12	81	7		NP
	100		6	20			SAND, gray, fine to coarse, poorly graded, medium dense to dense, angular to subrounded.							
	100													
	100		9	30		SP				0	97	3		
	100		12	40										
	100		15	50			GRAVELLY SAND, brown to gray, fine to coarse, poorly to well graded, medium dense to very dense, angular; trace to some fine gravel; trace nonplastic silt.	cobbles		25	68	7		
	100		18	60		SP-SM								

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ●(%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
	100		0	0		SM	SILTY SAND, brown, fine to coarse, poorly graded, dense, angular, calcareous; some nonplastic silt; little fine gravel.			18	48	34		
	100													
	100						GRAVELLY SAND, gray to brown, fine to coarse, well graded, medium dense, subangular; trace to some fine gravel; trace nonplastic silt.			10	85	5		
	100		3	10		SW-SM		cementation		24	67	9		
	100									12	81	7		NP
	100		6	20			SAND, gray, fine to coarse, poorly graded, medium dense to dense, angular to subrounded.							
	100													
	100		9	30		SP				0	97	3		
	100		12	40										
	100		15	50			GRAVELLY SAND, brown to gray, fine to coarse, poorly to well graded, medium dense, very dense, angular; trace to some fine gravel; trace nonplastic silt.	cobbles		25	68	7		
	100		18	60		SP-SM								


100
100
100
100
100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
SP-
SM
SW-
SM
cementation
TOTAL DEPTH 100.0' (30.5m)



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 4840' (1475m)
SURFICIAL GEOLOGIC UNIT	: A5i
DATE DRILLED	: 19 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING DM-B-1
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

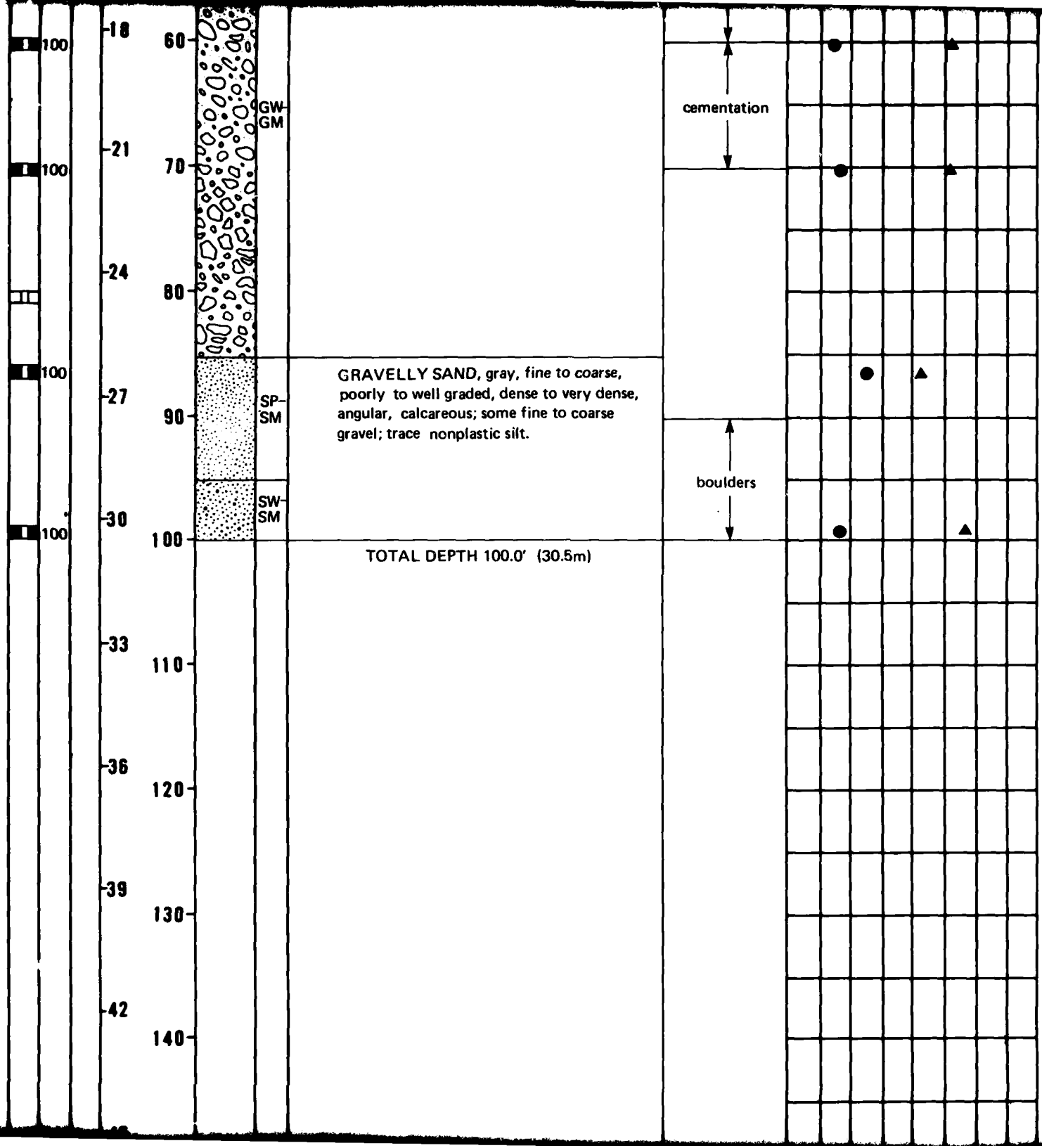
FIGURE
D-5-1

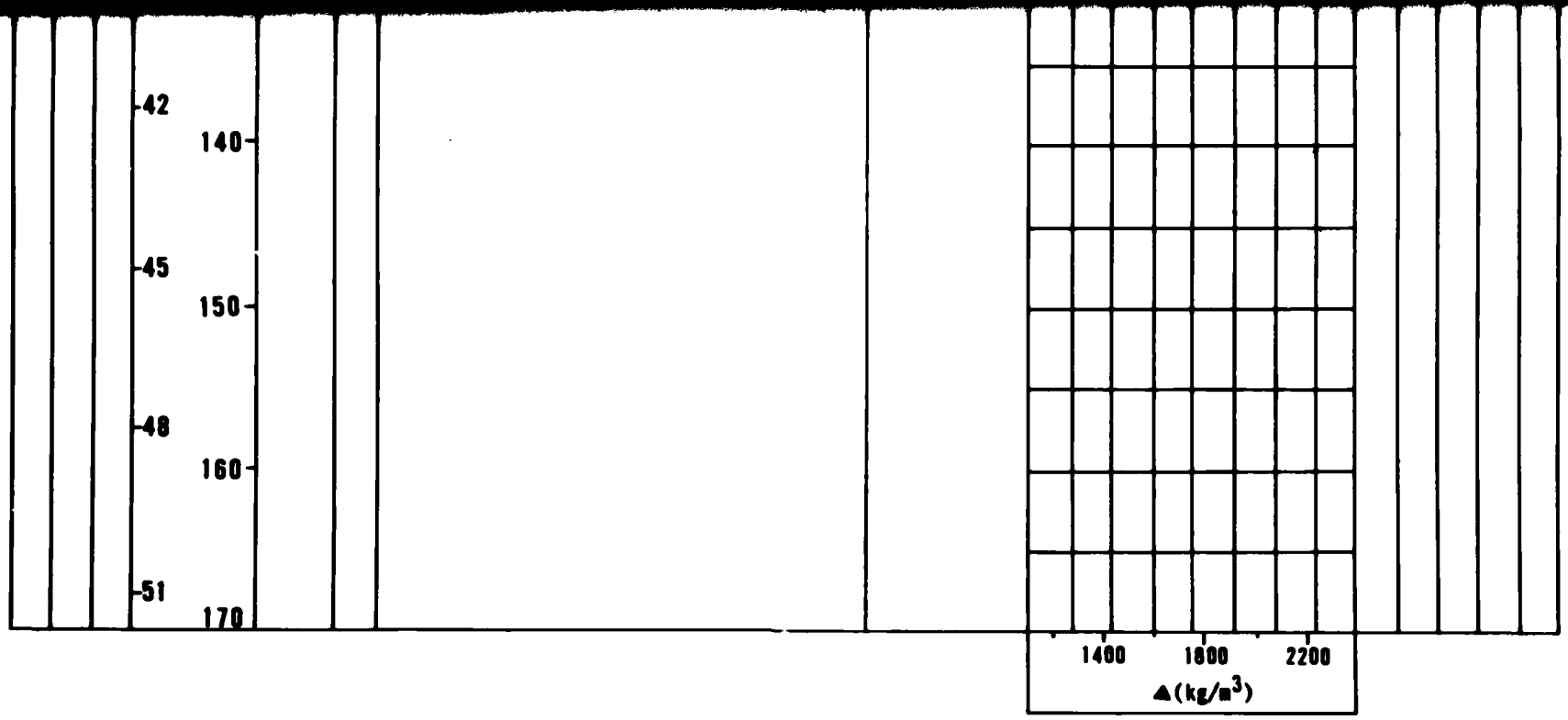
FUGRO NATIONAL, INC.

AFY-80

13

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ● (%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
	100		0	0		SM	SILTY SAND, brown, fine to coarse, poorly graded, loose to dense, angular, calcareous; some nonplastic silt; trace fine gravel.			5	68	27		NP
	100													
	100						GRAVELLY SAND, gray to dark gray, fine to coarse, well graded, dense to very dense; angular; little to some fine to coarse gravel; trace nonplastic silt.							
	100									35	58	7		
	100		3	10		SW-SM								
	100									13	82	5		
			6	20										
	100					SW				19	77	4		
	100		9	30										
						SW-SM		cementation						
	100		12	40						30	58	12		NP
	100		15	50			SANDY GRAVEL, gray, fine to coarse, well graded, very dense, angular, calcareous; some fine to coarse angular sand; trace nonplastic silt.			51	42	7		
								cobbles						
	100		18	60						58	34	8		NP
						GW-GM		cementation						


100
100
100
100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
GW-GM
SP-SM
SW-SM
GRAVELLY SAND, gray, fine to coarse, poorly to well graded, dense to very dense, angular, calcareous; some fine to coarse gravel; trace nonplastic silt.
TOTAL DEPTH 100.0' (30.5m)
cementation
boulders
58 34 8 NP
44 44 12
40 49 11
45 47 8



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5265' (1605m)
SURFICIAL GEOLOGIC UNIT	: A5i
DATE DRILLED	: 19 - 20 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING DM-B-2
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

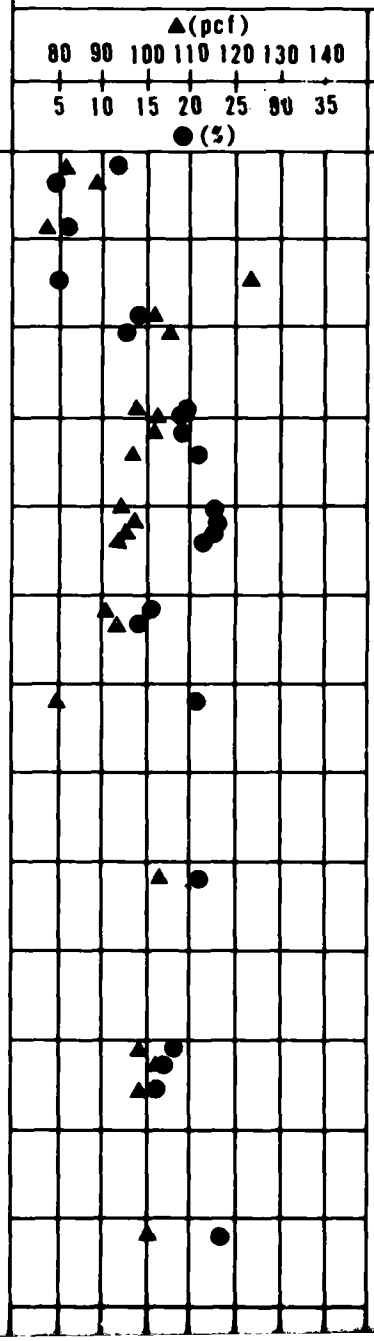
FIGURE II-5-2

FUGRO NATIONAL, INC.

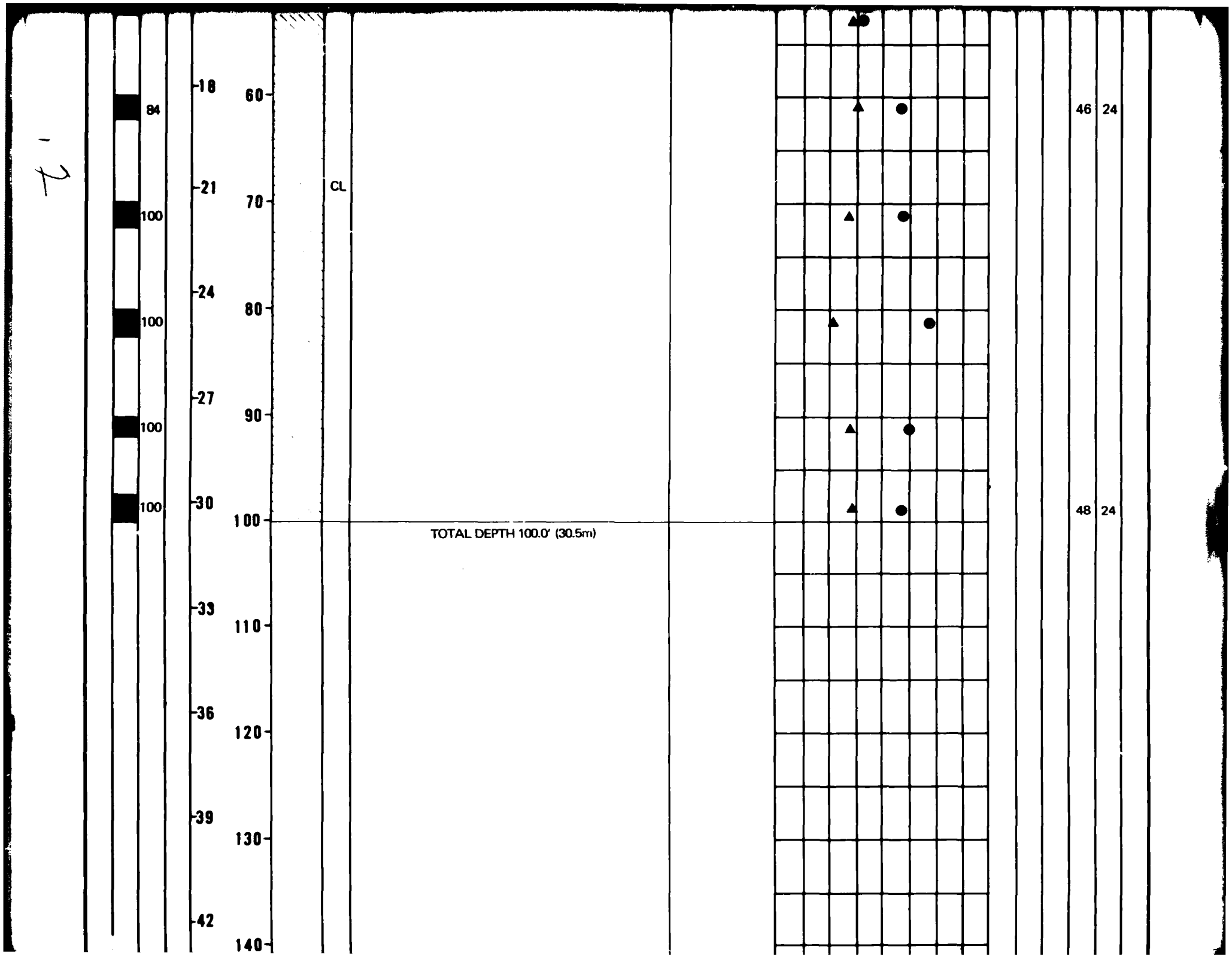
APV-00

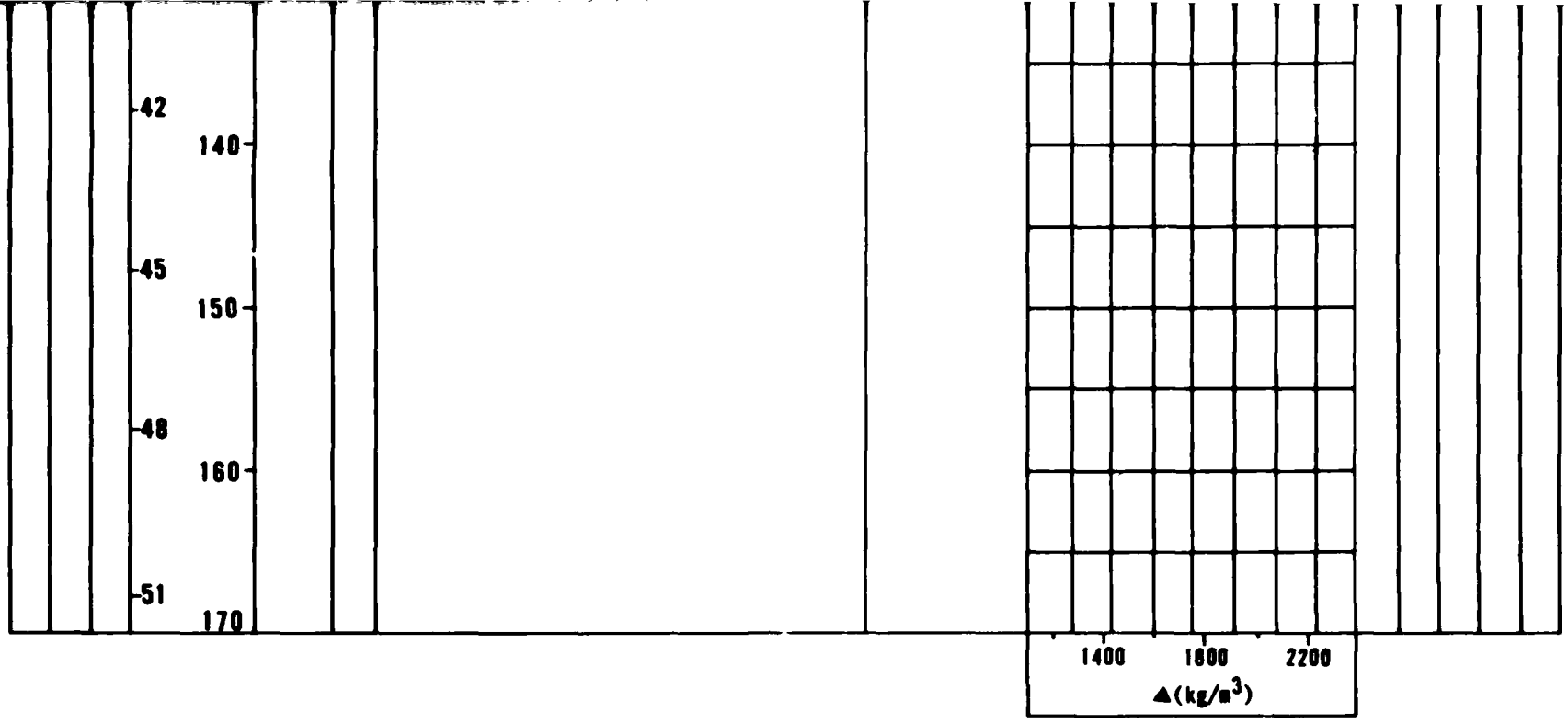
13

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	GR	SA	FI	LL	PI
	96		0	0		ML	SILT, brown, soft, slightly plastic, calcareous.		0	1	99	33	9
	100												
	93					SM	SILTY SAND, brown, fine to coarse, poorly graded, medium dense, subangular to subrounded, calcareous; some nonplastic silt.		2	73	25		NP
	90		3	10		CL			0	22	78	32	12
	100						SANDY CLAY, brown, stiff, slightly plastic, calcareous; some fine to medium subangular to subrounded sand.					44	23
	100		6	20		CL	CLAY, brown, firm, medium plastic, calcareous.					46	20
	96											41	18
	96		9	30		ML	SILT, brown, firm, slightly plastic, calcareous.					41	15
	100		12	40			CLAY, brown, firm to stiff, slightly to medium plastic, calcareous.		0	2	98	46	22
	100		15	50								34	15
	84		18	60								46	24



SIEVE ANALYSIS


84
100
100
100
100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
CL
TOTAL DEPTH 100.0' (30.5m)
46 24
48 24



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 4540' (1384m)
SURFICIAL GEOLOGIC UNIT	: A1
DATE DRILLED	: 27 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING DM-B-3
DELAMAR VALLEY, NEVADA

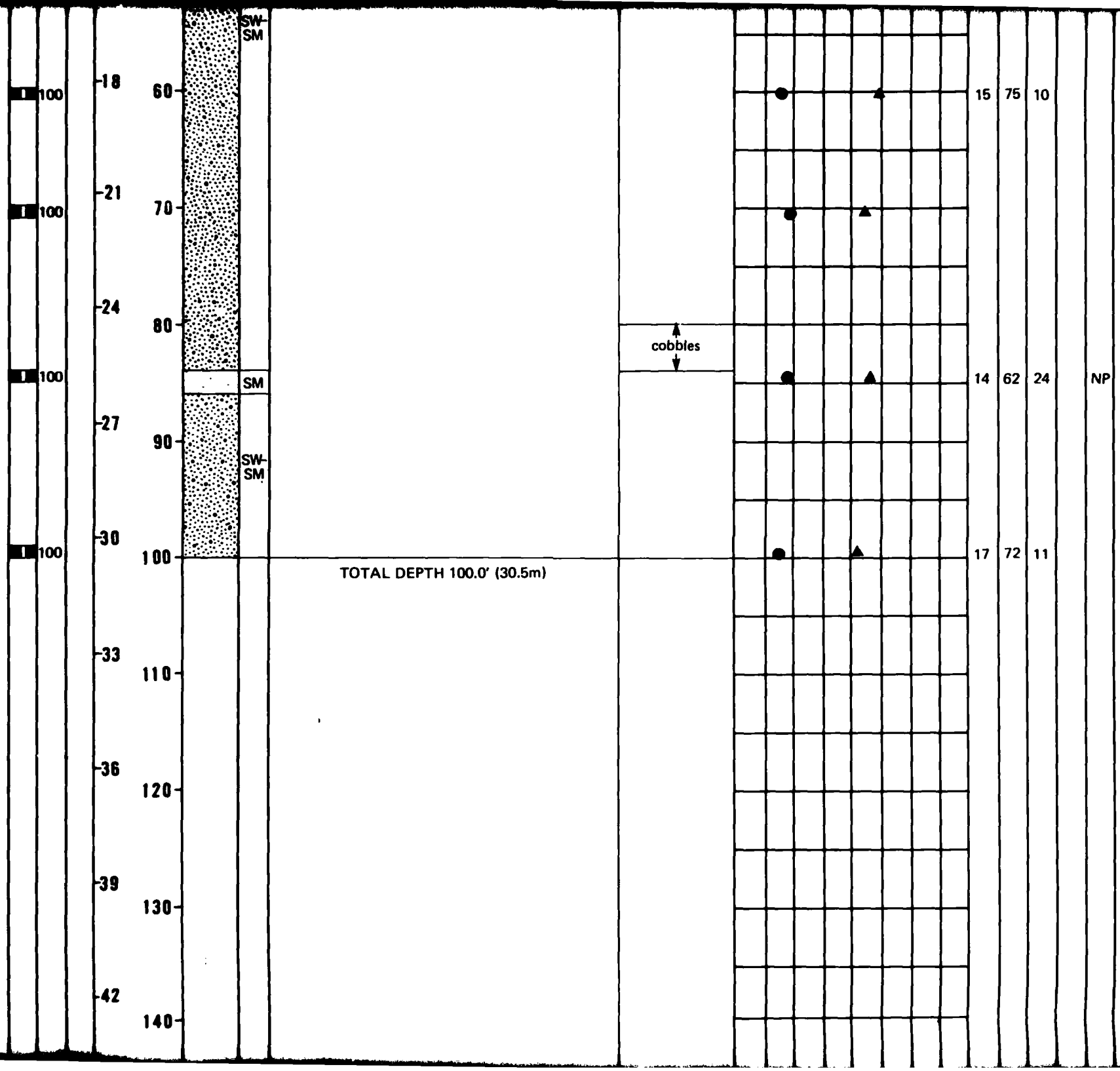
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

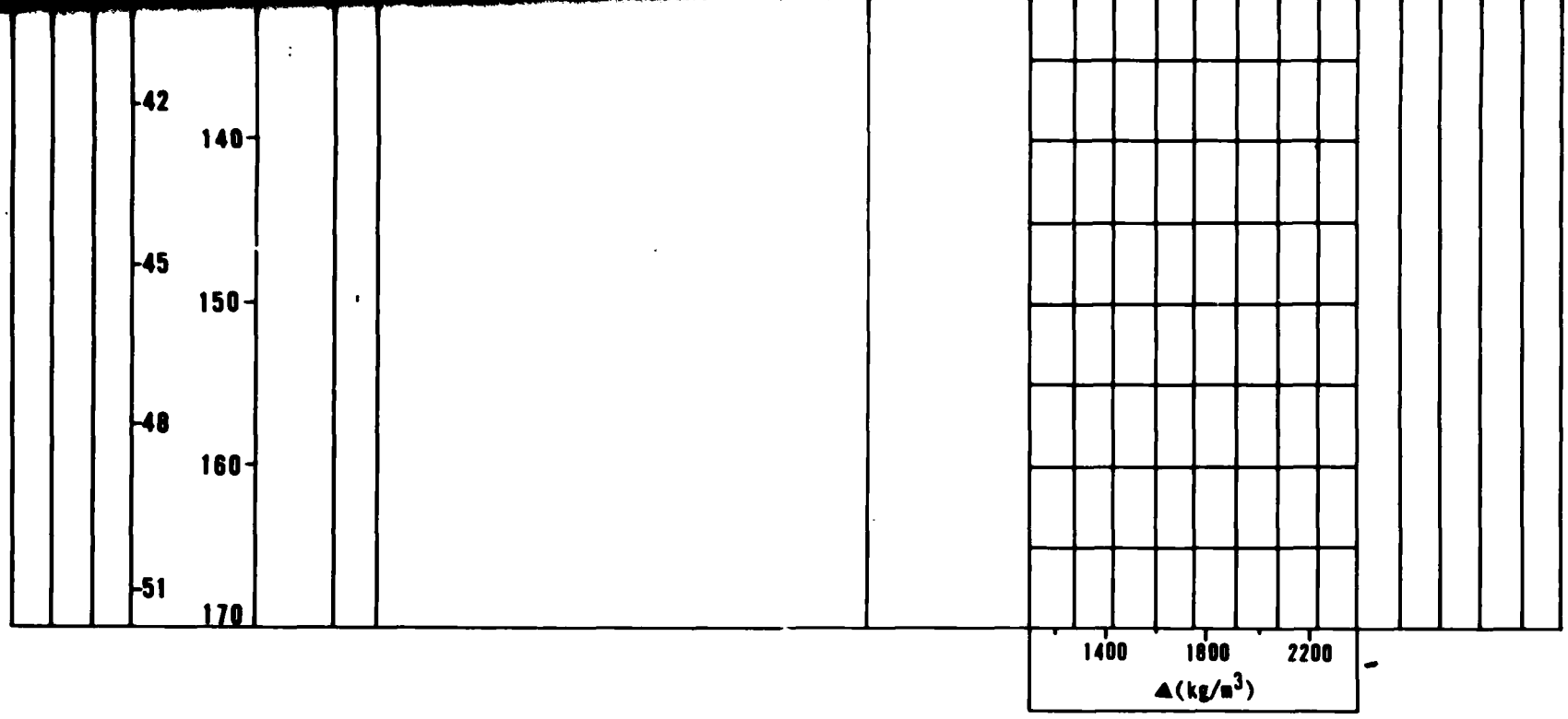
FIGURE
II-5-3

FUGRO NATIONAL, INC.

APV-90

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ● (%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
	47		0	0		SM	SILTY SAND, brown, fine to coarse, poorly graded, loose, angular, calcareous; some nonplastic silt; trace fine gravel.			7	63	30		NP
	100					GW-GM	SANDY GRAVEL, gray-brown, fine to coarse, well graded, loose to medium dense, angular, calcareous; some fine to coarse sand; trace nonplastic silt.	cobbles		45	43	12		
	100					SM		cementation		2	63	35		
	100		3	10						32	43	25		
						SM	GRAVELLY SAND, brown to dark gray, fine to coarse, poorly to well graded, dense to very dense, angular to subrounded, calcareous; trace to some fine to coarse angular gravel; trace to some nonplastic silt; layers of silty sand (8.0' - 10.0' and 84.0' - 87.0').							
	100		6	20						24	65	11		
	100					SP-SM								
	100		9	30						12	80	8		
	100		12	40										
	100		15	50		SW-SM								
	100		18	60						15	75	10		
			21											


SW-SM
SM
SW-SM
100
100
100
100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
cobbles
TOTAL DEPTH 100.0' (30.5m)
15 75 10
14 62 24
17 72 11
NP



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 4790' (1460m)
SURFICIAL GEOLOGIC UNIT	: A5y
DATE DRILLED	: 27 - 28 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING DM-B-4
DELAMAR VALLEY, NEVADA

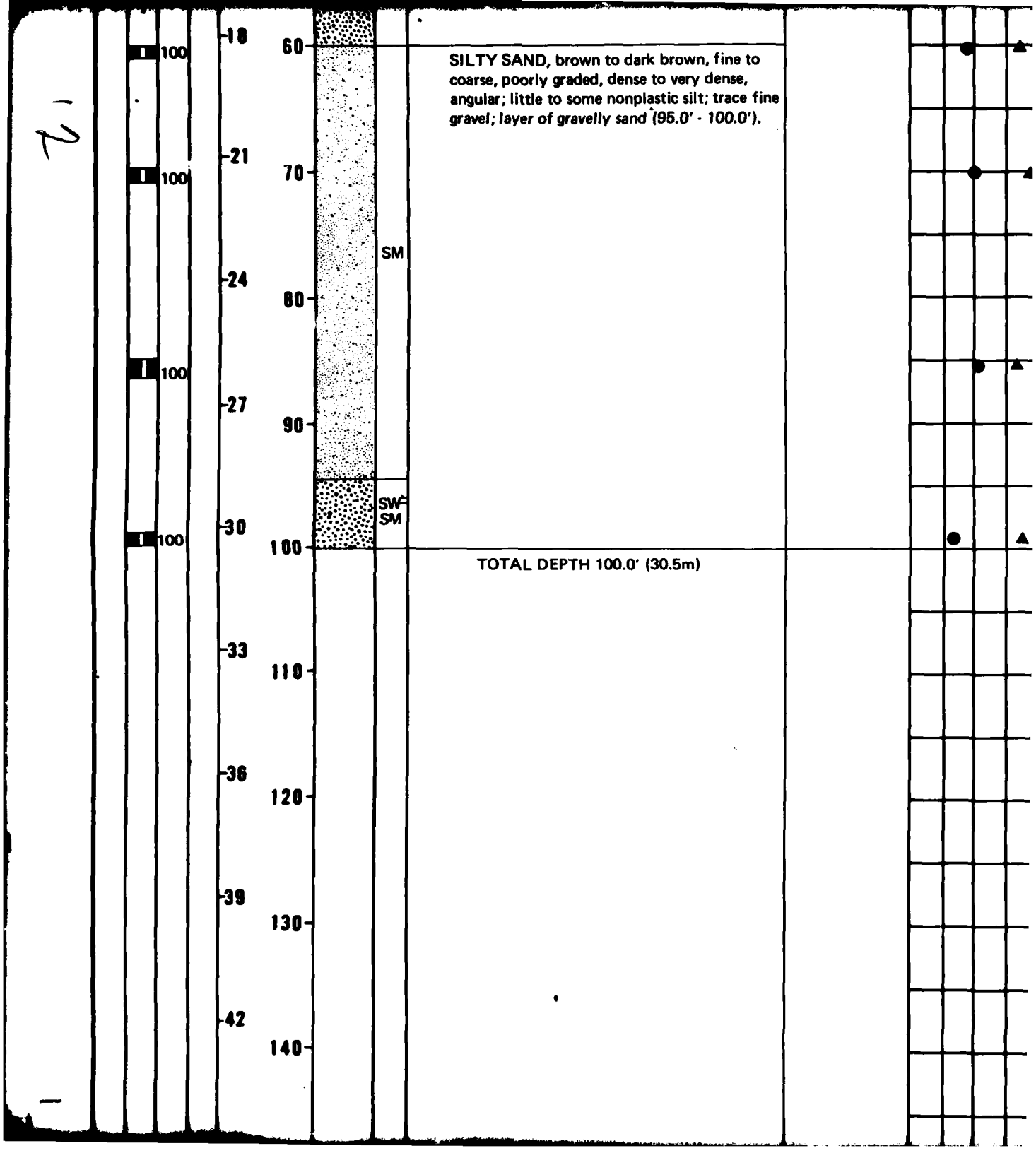
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

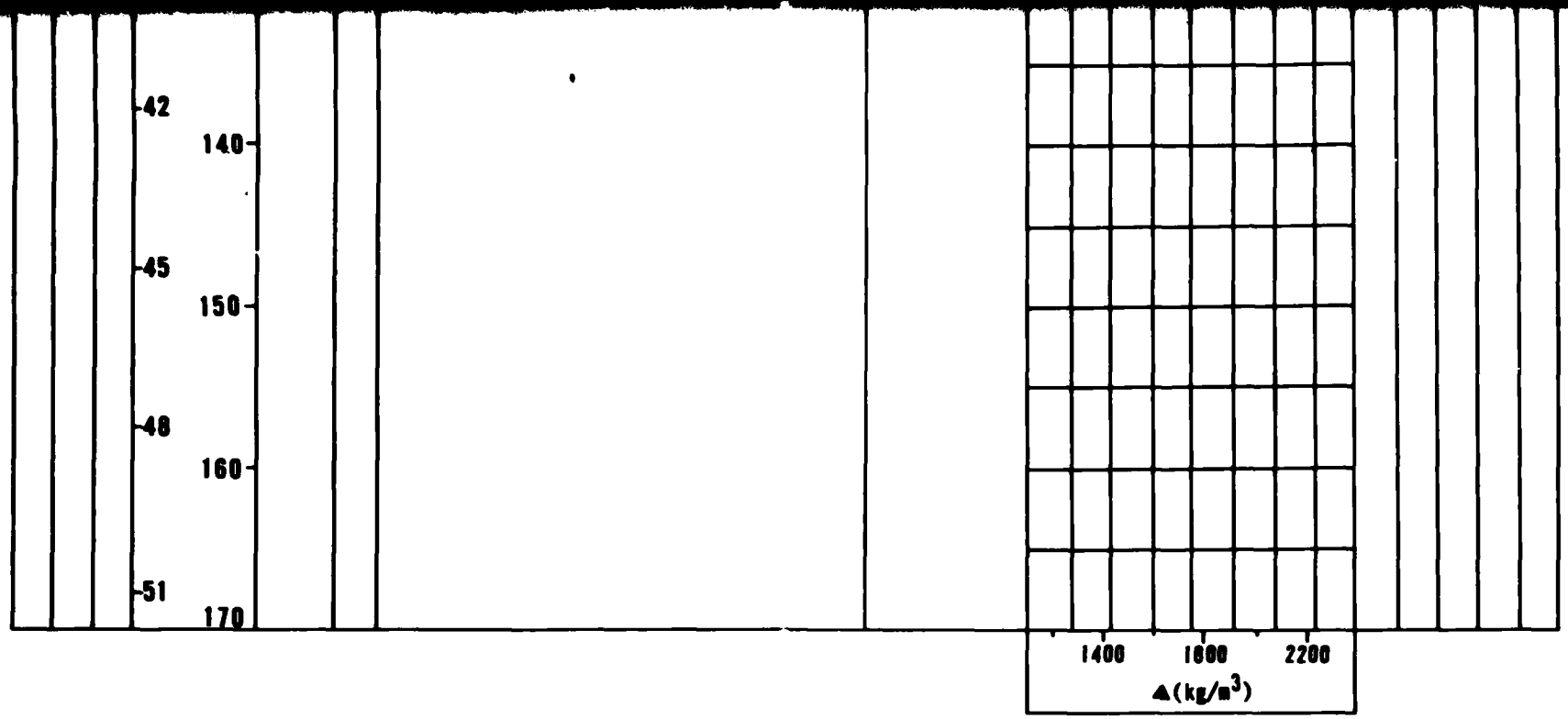
FIGURE II-5-4

FUGRO NATIONAL, INC.

AFY-80

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ● (%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
	100		0	0		SC	CLAYEY SAND, brown, fine to coarse, poorly graded, loose, angular to subangular, calcareous; some slightly plastic clay.			2	56	42	23	8
	92													
	100					SM	SILTY SAND, brown, fine to coarse, poorly graded, medium dense, angular, calcareous; little nonplastic silt; trace fine gravel.			9	71	20		NP
	100		3	10		SP-SM	GRAVELLY SAND, dark brown, fine to coarse, poorly graded, medium dense, angular to subangular; some fine to coarse gravel; trace nonplastic silt.			34	61	5		
	100									2	76	22		
	100		6	20		SM	SILTY SAND, light brown to brown, fine to coarse, poorly graded, medium dense to dense, angular, calcareous; little to some nonplastic silt; trace fine gravel.							
	100									4	76	20		
	100		9	30						10	76	14		
										2	56	42		
	100		12	40		SW-SM	SAND, brown, fine to coarse, well graded, dense, angular; trace fine gravel; trace nonplastic silt.			6	88	6		
	100		15	50										
	100		18	60			SILTY SAND, brown to dark brown, fine to coarse, poorly graded, dense to very dense, angular; little to some nonplastic silt; trace fine gravel; layer of gravelly sand (95.0' - 100.0').			0	86	14		


100
100
100
100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
SM
SW-SM
SILTY SAND, brown to dark brown, fine to coarse, poorly graded, dense to very dense, angular; little to some nonplastic silt; trace fine gravel; layer of gravelly sand (95.0' - 100.0').
TOTAL DEPTH 100.0' (30.5m)



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 4660' (1420 m)
SURFICIAL GEOLOGIC UNIT	: A1
DATE DRILLED	: 28 - 29 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING DM-B-5
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

FIGURE II-5-5

FUGRO NATIONAL, INC.

AFV-88

13

6.0 EXPLANATION OF TRENCH AND TEST PIT LOGS

See Section 5.0, "Boring Logs," for explanation.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	dense	SILTY SAND, brown, fine to coarse, poorly graded, dry, subangular, calcareous; some nonplastic silt; trace fine gravel; stage III - IV caliche (2.0' - 4.0').	vertical walls stable	5	67	28		NP
		2			very dense							
	1	4				TOTAL DEPTH 4.0' (1.2m)	cementation at 4.0' exceeded capacity of Case 580C backhoe					
		6										
	2											
		8										
	3	10										
		12										
	4											
		14										
		16										
	5											
		18										
	6	20										

TRENCH DETAILS

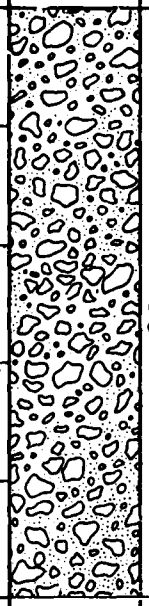
SURFACE ELEVATION : 4930' (1503m)
DATE EXCAVATED : 16 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5y
TRENCH LENGTH : 10.0' (3.0m)
TRENCH ORIENTATION : NW–SE

LOG OF TRENCH DM-T-1
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-1

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		GW-GM	medium dense	SANDY GRAVEL, brown, fine to coarse, well graded, dry, angular to subangular, calcareous; some fine to coarse sand; trace non-plastic silt; occasional cobbles and boulders to 14" size.	vertical walls stable	44	44	12		
		2										
	1											
		4			dense							
		6										
	2											
		8			very dense							
	3	10				TOTAL DEPTH 10.0' (3.0m)	excavation capacity of Case 580C backhoe exceeded at 10.0'					
		12										
	4											
		14										
		16										
	5											
		18										
	6											
		20										

TRENCH DETAILS

SURFACE ELEVATION : 5540' (1689m)
DATE EXCAVATED : 17 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5i
TRENCH LENGTH : 15.0' (4.6m)
TRENCH ORIENTATION : NW-SE

LOG OF TRENCH DM-T-2
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-2

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	dense	SILTY SAND, brown, fine to coarse, poorly graded, slightly moist, angular to sub-angular, calcareous; some nonplastic silt; trace fine gravel; state II-III caliche (3.0'-4.0')	vertical walls unstable	5	66	29		
		2										
	1											
		4		SP	loose	GRAVELLY SAND, brown, fine to coarse, poorly graded, dry, angular to subangular, calcareous; little fine gravel (8.0'-14.0'); occasional cobbles and boulders to 16" size throughout.		15	82	3		
		6										
	2											
		8		SP-SM	loose							
	3	10										
		12										
	4											
		14				TOTAL DEPTH 14.0' (4.3m)						
		16										
	5											
		18										
	6											
		20										

TRENCH DETAILS

SURFACE ELEVATION : 5280' (1609m)
DATE EXCAVATED : 17 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5i
TRENCH LENGTH : 16.0' (4.9m)
TRENCH ORIENTATION : E-W

LOG OF TRENCH DM-T-3
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-3

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	GRAVELLY SAND, brown and white, fine to coarse, poorly graded, slightly moist, angular to subangular, calcareous; some fine gravel; little nonplastic silt; stage III-IV caliche (1.5'-6.0')	vertical walls stable	22	62	16		
		2			dense							
	1											
		4			very dense							
		6				TOTAL DEPTH 6.0' (1.8m)	cementation at 6.0' exceeded capacity of Case 580C backhoe					
	2											
		8										
	3	10										
		12										
	4											
		14										
		16										
	5											
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 4840' (1475m)
DATE EXCAVATED : 18 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5i
TRENCH LENGTH : 10.0' (3.0m)
TRENCH ORIENTATION : E-W

LOG OF TRENCH DM-T-4
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-4

FUGRO NATIONAL, INC.

FN-TR-27-DM-II

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM		SILTY SAND, brown, fine to coarse, poorly graded, slightly moist, subangular, calcareous; some slightly plastic silt; trace fine gravel.	vertical walls stable	5	54	41		
		2		SP	medium dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, dry, subangular, calcareous; some fine to coarse gravel.		25	72	3		
	1	4										
		6										
	2											
		8										
	3	10										
		12										
	4											
		14				TOTAL DEPTH 14.0' (4.3m)						
		16										
	5											
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 4660' (1420m)
DATE EXCAVATED : 18 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A1
TRENCH LENGTH : 16.0' (4.9m)
TRENCH ORIENTATION : E-W

LOG OF TRENCH DM-T-5
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-5

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	SILTY SAND, brown, fine to coarse, poorly graded, dry, subangular, calcareous; some nonplastic silt; little fine angular to subangular gravel; interbedded lenses of fine to coarse angular to subangular gravel (GP) at (3.5' - 4.5').	vertical walls stable	20	54	26		NP
		2										
	1											
		4			loose		sloughing					
		6			very dense		vertical walls stable					
	2											
						TOTAL DEPTH 7.0' (2.1m)	excavation capacity of Case 580C backhoe exceeded at 7.0'					
		8										
	3	10										
		12										
	4											
		14										
		16										
	5											
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 4640' (1414m)
DATE EXCAVATED : 18 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5y
TRENCH LENGTH : 12.0' (3.7m)
TRENCH ORIENTATION : N-S

LOG OF TRENCH DM-T-6
DELAMAR VALLEY, NEVADA

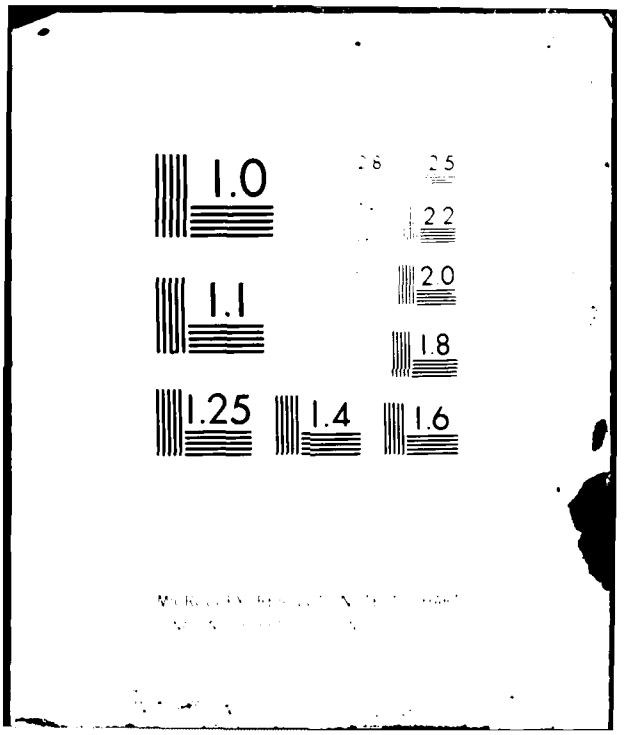
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-6

FUGRO NATIONAL, INC.

AD-A113 391 FUGRO NATIONAL INC LONG BEACH CA F/G 13/2
VERIFICATION STUDY - DELAMAR VALLEY, NEVADA. VOLUME II. GEOTECH--ETC(U)
MAR 81 F04704-80-C-0006
UNCLASSIFIED FN-TR-27-DM-VOL-2 NL

2 OF 3
AD A
113391


1.0
2.8
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		ML	stiff	SILT, brown, slightly moist, slightly plastic, calcareous; interbedded lenses of fine to medium subangular sand throughout.	vertical walls stable	0	3	97	35	10
	1	2										
		4										
	2	6		SW	very dense	GRAVELLY SAND, brown, fine to coarse, well graded, slightly moist, angular to subangular, calcareous; some fine to coarse gravel; stage III-IV caliche (6.0'-7.0')	cementation at 7.0' exceeded capacity of Case 580C backhoe	27	70	3		
		8				TOTAL DEPTH 7.0' (2.1m)						
	3	10										
		12										
	4	14										
	5	16										
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 4540' (1384m)
DATE EXCAVATED : 18 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A1
TRENCH LENGTH : 12.0' (3.7m)
TRENCH ORIENTATION : E-W

LOG OF TRENCH DM-T-7
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-7

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	GRAVELLY SAND, light brown, fine to coarse, poorly graded, slightly moist, angular to subangular, calcareous; some fine to coarse gravel; some nonplastic silt.	vertical walls stable	32	46	22		
		2										
	1	4		SP	medium dense	SAND, brown, fine to coarse, poorly graded, slightly moist, angular, calcareous; trace fine gravel.						
	2	6										
		8										
	3	10										
		12										
	4	14				TOTAL DEPTH 14.0' (4.3m)						
	5	16										
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 5230' (1594m)
DATE EXCAVATED : 19 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5i
TRENCH LENGTH : 16.0' (4.9m)
TRENCH ORIENTATION : NE-SW

LOG OF TRENCH DM-T-8
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-8

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SP-SM	dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, slightly moist, angular to subangular, calcareous; some fine angular gravel; trace nonplastic silt; occasional cobbles to 8" size; stage IV caliche (1.5' - 2.0').	vertical walls stable	31	57	12		
		2			very dense	TOTAL DEPTH 2.0' (0.6m)	cementation at 2.0' exceeded capacity of Case 580C backhoe					
	1	4										
		6										
	2	8										
	3	10										
		12										
	4	14										
		16										
	5	18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 5260' (1603m)
DATE EXCAVATED : 19 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5i
TRENCH LENGTH : 6.0' (1.8m)
TRENCH ORIENTATION : E-W

LOG OF TRENCH DM-T-9
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-9

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	loose	GRAVELLY SAND, brown, fine to coarse, poorly graded, dry, subangular, calcareous; some fine to coarse gravel; little nonplastic silt.	vertical walls unstable	32	55	13		
		2										
	1	4		SM	loose	SILTY SAND, brown, fine to coarse, poorly graded, dry, subangular, calcareous; some nonplastic silt· little fine gravel; occasional cobbles (9.5'-10.0'); stage IV caliche (9.5'-10.0')		16	54	30		NP
	2	6										
		8										
	3	10			very dense		vertical walls stable					
						TOTAL DEPTH 10.0' (3.0m)	cementation at 10.0' exceeded capacity of Case 580C backhoe					
		12										
	4	14										
	5	16										
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 4790' (1460m)
DATE EXCAVATED : 19 NOVEMBER 1979
SURFICIAL GEOLOGIC UNIT : A5y
TRENCH LENGTH : 15.0'(4.6m)
TRENCH ORIENTATION : N-S

LOG OF TRENCH DM-T-10
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-10

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		CL-ML	firm	SANDY CLAY-SANDY SILT, brown, dry, slightly plastic, calcareous; some fine to medium subangular sand.	vertical walls stable	2	47	51	21	5
	1	1		SW-SM	dense	GRAVELLY SAND, brown, fine to coarse well graded, dry, subangular, calcareous; some fine to coarse gravel; trace nonplastic silt.		45	46	9		
	2	2										
	3	3										
	4	4										
	5	5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4640' (1414m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT DM-P-1

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM-SC	medium dense	SILTY SAND-CLAYEY SAND, brown, fine to coarse, poorly graded, slightly moist, subangular, calcareous; some slightly plastic silty clay; trace fine gravel.	vertical walls stable	6	63	31	20	6
	1	1		SP-SM	dense	GRAVELLY SAND, gray, fine to coarse, poorly graded, slightly moist, angular to subangular, calcareous; little fine gravel; trace nonplastic silt; stage II caliche.		16	79	5		
	2	2										
	3	3										
	4	4										
	5	5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4785' (1458m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-2

LOGS OF TEST PITS DM-P-1 AND DM-P-2
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-11

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	SILTY SAND, brown, fine to coarse, poorly graded, slightly moist, subangular, calcareous, little nonplastic silt; little fine to coarse angular to subangular gravel.	vertical walls stable					
		1										
		2										
	1	3										
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4980' (1518m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-3

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SW-SM	medium dense	GRAVELLY SAND, brown, fine to coarse, well graded, dry, angular, calcareous; some fine to coarse gravel; trace nonplastic silt.	vertical walls stable	30	64	6		
		1										
		2										
	1	3										
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5100' (1554m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-4

LOGS OF TEST PITS DM-P-3 AND DM-P-4
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-12

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	dense	SILTY SAND, brown, fine to coarse, poorly graded, dry, subangular, calcareous; little nonplastic silt.	vertical walls stable					
		1			very dense							
		2				TOTAL DEPTH 1.5' (0.5m)	excavation capacity of Case 580C backhoe exceeded at 1.5'					
	1	3										
		4										
		5										

SURFACE ELEVATION: 4865' (1483m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-5

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SW-SM	medium dense	GRAVELLY SAND, brown, fine to coarse, well graded, dry, subangular, calcareous; little fine to coarse gravel; trace nonplastic silt; occasional cobbles to 11" size.	vertical walls stable	13	77	10		
		1										
		2										
	1	3										
		4			dense							
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5145' (1568m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-6

LOGS OF TEST PITS DM-P-5 AND DM-P-6
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-13

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	SILTY SAND, light brown to dark brown, fine to coarse, poorly graded, slightly moist, angular to subangular, calcareous; little to some nonplastic silt; non to trace fine to coarse gravel; occasional cobbles to 5" size (0.0' - 2.0'); stage III caliche (2.0' - 3.0'); stage II caliche (3.0' - 5.0').	vertical walls stable	6	73	21		
		1										
		2			very dense							
	1	3						0	80	20		
		4			dense							
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5264' (1604m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-7

	0	0		SP-SM	medium dense	GRAVELLY SAND, brown to light brown, fine to coarse, poorly graded, slightly moist, angular to subangular, calcareous; some fine to coarse gravel; trace nonplastic silt; stage II caliche (1.0'-5.0').	vertical walls stable					
		1										
		2										
	1	3			dense							
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5520' (1682m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-8

LOGS OF TEST PITS DM-P-7 AND DM-P-8
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-14

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0				SILTY SAND, brown, fine to medium, poorly graded, slightly moist, subangular, calcareous; some nonplastic silt.						
		1						4	71	25		
		2		SM	loose		vertical walls unstable					
	1	3										
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4860' (1481m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT DM-P-9

	0	0			medium dense	SILTY SAND, brown, fine to coarse, poorly graded, slightly moist, angular to subangular, calcareous; some nonplastic silt; stage III caliche (1.0'-5.0')						
		1										
		2		SM	dense		vertical walls stable					
	1	3										
		4			very dense							
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4920' (1500m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT DM-P-10

LOGS OF TEST PITS DM-P-9, AND DM-P-10
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-15

FUGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, slightly moist, subangular, calcareous; little fine to coarse gravel; little nonplastic silt; stage III caliche (1.5'-3.5')	vertical walls stable					
		1										
		2			very dense							
		3										
	1											
		4				TOTAL DEPTH 3.5' (1.1m)	cementation at 3.5' exceeded capacity of Case580C backhoe					
		5										

SURFACE ELEVATION: 4680' (1426m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT DM-P-11

	0	0		SM	medium dense	SILTY SAND, brown, fine to medium, poorly graded, slightly moist, subangular, calcareous; some nonplastic silt.	vertical walls stable					
		1										
		2										
		3										
	1											
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4710' (1436m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT DM-P-12

LOGS OF TEST PITS DM-P-11 AND DM-P-12
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-6-16

UGRO NATIONAL, INC.

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0				SILT, brown, slightly moist, nonplastic, calcareous; trace fine subangular sand.						
		1						0	12	88		NP
		2		ML	stiff		vertical walls stable					
	1	3										
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4505' (1373m)
SURFICIAL GEOLOGIC UNIT: A1

LOG OF TEST PIT DM-P-13

	0	0				GRAVELLY SAND, brown, fine to coarse, poorly graded, dry, angular to subangular, calcareous; some fine to coarse gravel; little nonplastic silt.						
		1										
		2		SM	medium dense		vertical walls stable					
	1	3										
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4650' (1417m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT DM-P-14

LOGS OF TEST PITS DM-P-13 AND DM-P-14
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-6-17

FUGRO NATIONAL, INC.

7.0 EXPLANATION OF SURFICIAL SOIL SAMPLE LOGS

Finalized logs of the surficial samples are presented in this section. Explanations of the column headings on the logs follow:

A. Designations - Surficial samples are identified as follows:

DM-CS-1
DM - abbreviation for the valley (e.g., DM-Delamar)
CS - abbreviation for surficial sample
1 - number of activity

B. Ground Surface Elevation - Indicated elevations on the logs are estimated from topographic maps of the study area within an accuracy of half the contour interval.

C. Surficial Geologic Unit - Indicates the surficial geologic unit in which the activity is located.

D. Depth - Indicates depth interval for which soil description is given.

E. USCS - Unified Soil Classification Symbol; see Table II-5-1 of Section 5.0, "Borings Logs," for details of USCS.

F. Soil Description - Soil is described based on field visual descriptions and/or laboratory test results. See Section 5.0, "Boring Logs," for procedures of soil description.

G. Sieve Analysis, LL and PI - These are from results of laboratory tests. See Section 5.0, "Boring Logs," for explanation.

ACTIVITY NUMBER	GROUND SURFACE ELEVATION, FEET (METERS)	SURFICIAL GEOLOGIC UNIT	DEPTH, FEET (METERS)	USCS	SOIL DESCRIPTION	SIEVE ANALYSIS GR	SA	FI	LL	PI
DM-CS-1	4810 (1466)	A5i	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, red - brown, fine to coarse, poorly graded, subangular, calcareous; little nonplastic silt; little fine to coarse gravel.					
DM-CS-5	4920 (1500)	A5i	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, angular to subangular, calcareous; little nonplastic silt; trace fine to coarse gravel.					
DM-CS-9	4850 (1478)	A5y	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; some non to slightly plastic silt; trace fine gravel.					
DM-CS-11	5020 (1530)	A5y/A5i	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; little nonplastic silt.	4	77	19		
DM-CS-14	5390 (1643)	A5i	0.0 - 2.0 (0.0 - 0.6)	GP-GM	SANDY GRAVEL, brown, fine to coarse, poorly graded, subangular, calcareous; some fine to coarse sand; trace nonplastic silt.					
DM-CS-18	4920 (1500)	A5y	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; little nonplastic silt; trace fine gravel.					
DM-CS-20	4785 (1458)	A5y	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, brown, fine to medium, poorly graded, subangular, calcareous; little nonplastic silt.					
DM-CS-24	4660 (1420)	A1	0.0 - 2.0 (0.0 - 0.6)	CL-ML	SILTY CLAY - CLAYEY SILT, brown, slightly plastic, calcareous; trace fine subangular sand.	0	12	88	27	6
DM-CS-27	4740 (1445)	A5y	0.0 - 2.0 (0.0 - 0.6)	SM	GRAVELLY SAND, brown, fine to coarse, poorly graded, angular to subangular, calcareous; little gravel; little nonplastic silt.					
DM-CS-29	4505 (1373)	A1	0.0 - 2.0 (0.0 - 0.6)	ML	SANDY SILT, brown, slightly plastic, calcareous; some fine subangular sand.					
DM-CS-32	4555 (1388)	A5y	0.0 - 2.0 (0.0 - 0.6)	SM	GRAVELLY SAND, brown, fine to coarse, poorly graded, angular to subangular, calcareous; some fine angular gravel; little nonplastic silt.					
DM-CS-34	4560 (1390)	A5y	0.0 - 2.0 (0.0 - 6.0)	ML	SANDY SILT, brown, nonplastic, calcareous; some fine to medium subangular sand.	2	46	52		NP
DM-CS-36	4695 (1431)	A5i	0.0 - 2.0 (0.0 - 6.0)	SM	SILTY SAND, brown, fine to coarse, poorly graded, angular to subangular, calcareous; little nonplastic silt; trace fine gravel.					

LOGS OF SURFICIAL SOIL SAMPLES
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-7-1

FUGRO NATIONAL, INC.

8.0 EXPLANATION OF LABORATORY TEST RESULTS

Laboratory test results are presented in this section. Table II-8-1 contains a summary of laboratory test results. This table shows results of sieve analysis; plasticity data; in-situ dry unit weight, moisture content, degree of saturation, and void ratio for drive and Pitcher samples; results of compaction tests; and specific gravity of solids. Other tests such as triaxial compression, unconfined compression, direct shear, consolidation, chemical, and California Bearing Ratio (CBR) are indicated on the table. Tables II-8-2 through II-8-6 and Figures II-8-1 through II-8-4 present results of triaxial compression, unconfined compression, direct shear, chemical, and CBR tests.

All tests were performed in general accordance with the American Society for Testing and Materials (ASTM) procedures. The following list presents the ASTM designations for the tests performed during the investigation.

Type of Test	ASTM Designations
Particle Size Analysis	D 422-63
Liquid Limit	D 423-66
Plastic Limit	D 424-59
Unit Weight	D 2937-71
Moisture Content	D 2216-71
Compaction	D 1557-70
Specific Gravity of Solids	D 854-58
Triaxial	D 2850-70
Unconfined Compression	D 2166-66
Direct Shear	D 3080-72
Consolidation	D 2435-70
Test for Alkalinity (pH)	D 1067-70
Water Soluble Sodium	D 1428-64
Water Soluble Chloride	D 512-67
Water Soluble Sulphate	D 516-68
Water Soluble Calcium	D 511-72
Calcium Carbonate	D 1126-67
California Bearing Ratio (CBR)	D 1883-73

Explanation for the tables and figures presented in this section are as follows.

A. Activity Number - Boring, trench, test pit, or surface sample designation.

B. Sample Number - Prefix indicates the type of sample; explanation is at the bottom of the table.

C. Sample Interval - This is the depth range measured from ground surface over which the sample was obtained.

D. Percent Finer by Weight - Presents the results of laboratory particle size analysis (ASTM D 422-63) performed on representative soil samples at the depth indicated. The numbers represent the percent (by dry weight) of the total sample weight passing through each sieve size indicated.

E. Atterberg Limits (ASTM D 423-66 and D 424-59)

LL - Liquid Limit, the water content (as percent of soil dry weight) corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

F. USCS - Unified Soil Classification Symbols are given here; see Table II-5-1 in Section 5.0, "Boring Logs," for complete details of USCS system.

G. In Situ - Presents results of tests on drive and Pitcher samples.

Dry Unit Weight - Indicates dry unit weight of soil determined as per ASTM D 2937-71.

Moisture Content - Weight of water reported in percent of dry weight of soil sample (ASTM D 2216-71).

Saturation - The degree of saturation in a soil sample is defined as the ratio (in percent) of the volume of water to the volume of all voids in the soil.

Void Ratio - The numerical ratio of the volume of voids to the volume of solids in a soil specimen.

H. Compacted - Indicates results of laboratory maximum dry density and optimum moisture content test as per ASTM D 1557-70.

I. Specific Gravity of Solids (ASTM D 854-58) - Indicates the ratio of 1) the weight in air of a given volume of soil solids at a stated temperature, to 2) the weight in air of an equal volume of distilled water at a stated temperature.

J. Triaxial - The triaxial compression tests were performed in accordance with the procedures of ASTM D 2850-70. The following explanations and definitions apply.

Triaxial Compression Test - A cylindrical specimen of soil is surrounded by a fluid in a pressure chamber and subjected to an isotropic pressure. An additional compressive load is then applied, directed along the axis of the specimen called the axial load.

Consolidated-Drained (CD) Test - A triaxial compression test in which the soil was first consolidated under an all-around confining stress (test chamber pressure) and was then compressed (and hence

sheared) by increasing the vertical stress. "Drained" indicates that excess pore water pressure generated by strains are permitted to dissipate by the free movement of pore water during consolidation and compression.

Consolidated-Undrained (CU) Test - A triaxial compression test in which essentially complete consolidation under the confining (chamber) pressure is followed by a shear test at constant water content.

Confining Pressure (σ_3) - The isotropic chamber pressure applied to the soil specimen during consolidation and compression.

Maximum Deviator Stress ($\sigma_1 - \sigma_3$) - The difference between the major and minor principal stresses in the specimen at failure. The major principal stress on the specimen is equal to the unit axial load plus the chamber pressure and the minor principal stress on the specimen is equal to the chamber pressure.

Strain Rate - Axial strain, ε, at a given stress level is defined as the ratio of the change in length (ΔL) of the specimen to the original length of the specimen (L_o). The rate of strain was controlled during the test so that this ratio increased at equal increments for each minute of testing.

Back Pressure - Pressure in excess of atmospheric applied to the pore water of a soil sample. Back pressure is usually applied to (1) increase saturation of the sample, or (2) simulate the actual in-situ pressure regime.

K. Unconfined Compression - Test procedures were as described in ASTM D 2166-66. Unconfined compressive strength is defined as the load per unit area at which an unconfined prismatic or cylindrical specimen of soil will fail in a

simple compression test. In these methods, unconfined compressive strength is taken as the maximum load attained per unit area or the load per unit area at 20 percent axial strain, whichever occurred first during the performance of a test.

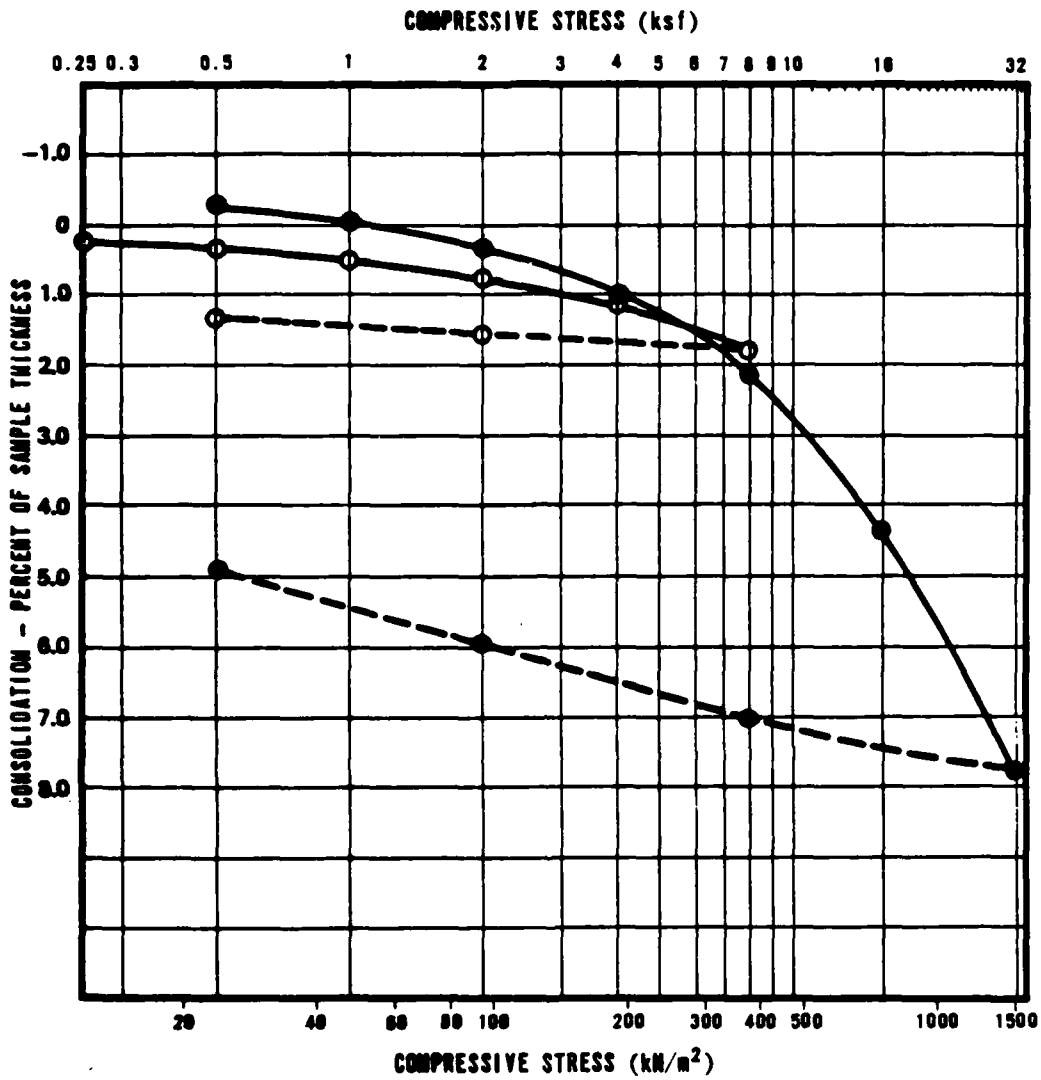
L. Direct Shear - The procedures of ASTM D 3080-72 were followed for direct shear testing. In this test, soil under an applied normal load is stressed to failure by moving one section of the soil container (shear box) relative to the other section. Normal stress is the value of load per unit area acting perpendicular to the plane of shearing. Maximum shear strength is defined as the maximum resistance (ksf) of a soil to shearing (tangential) stresses.

M. Consolidation (ASTM D 2435-70) - A consolidation test is a test in which a cylindrical soil specimen is laterally confined in a ring and compressed between porous plates. The term "consolidation," as used here, indicates the gradual reduction in volume of the soil mass resulting from an increase in compressive stress (axial load per unit area).

N. Chemical - The chemical tests performed on soil samples included: pH; water soluble sodium, chloride, sulphate, calcium; and calcium carbonate content. pH is an index of the acidity or alkalinity of a soil in terms of the logarithm of the reciprocal of the hydrogen ion concentration. ASTM test procedure designations for these chemical tests

are included in the list on the first page of these Explanations.

O. CBR - California Bearing Ratio (CBR) is the ratio (in percent) of the resistance to penetration developed by a subgrade soil to that developed by a standard crushed-rock base material. The procedures for conducting a CBR test were as outlined in ASTM D 1883-73. The materials tested for CBR were also analyzed for particle-size distribution (ASTM D 422-63) and compaction characteristics (ASTM D 1557-70). The term "percentage of maximum density" indicates the ratio (as a percentage) of the compacted sample dry unit weight to maximum dry density obtained in the laboratory from ASTM D 1557-70, "Moisture-Density Relations of Soils Using 10-pound (4.5-kg) Hammer and 18-inch (457-mm) Drop."



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	DM-B-3	P-10	51.0-52.5	15.73-16.00	CL	98.9	1584	15.5	0.62	64.3

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

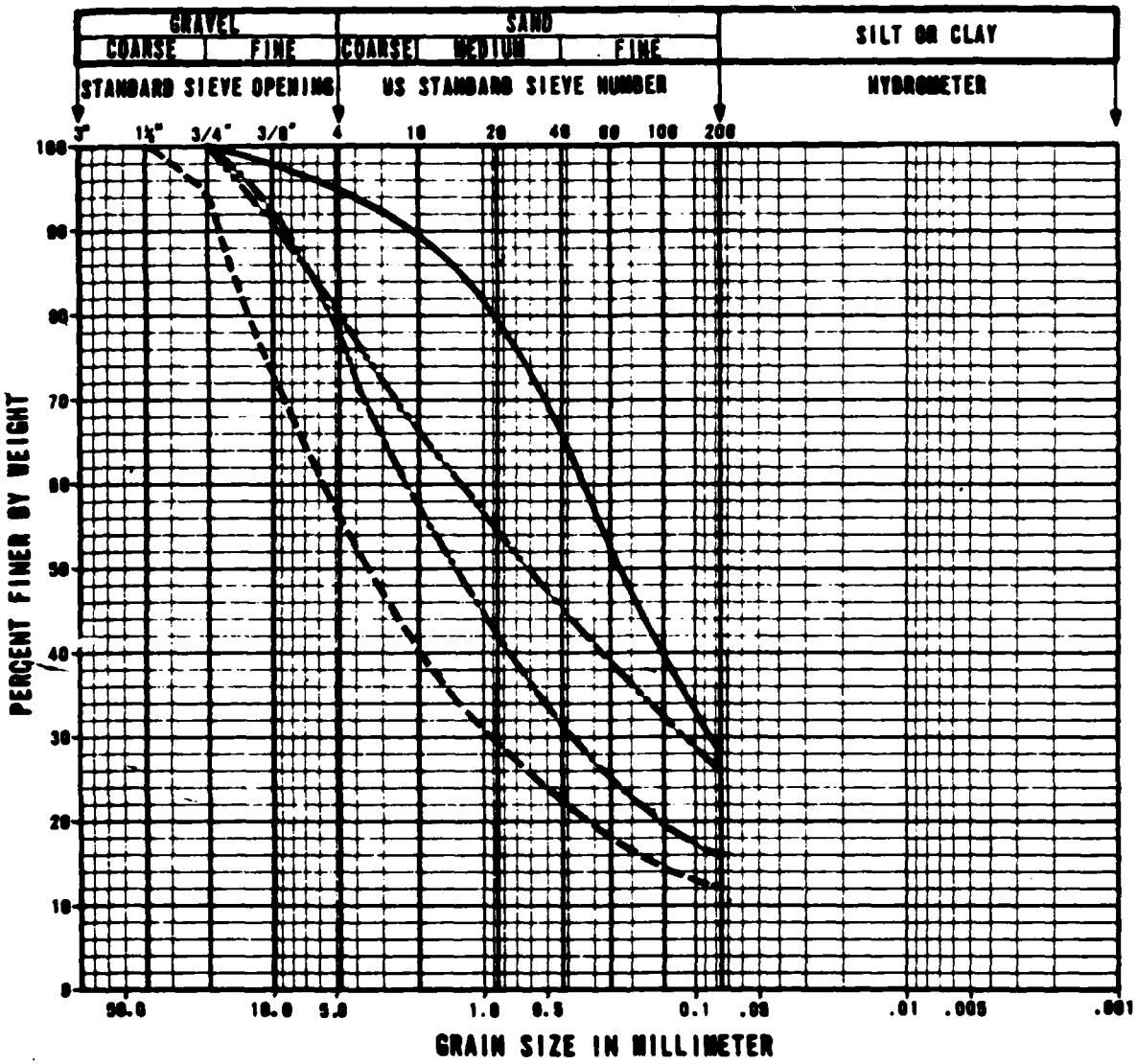
— — — REBOUND

CONSOLIDATION TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-8-1

FUGRO NATIONAL, INC.



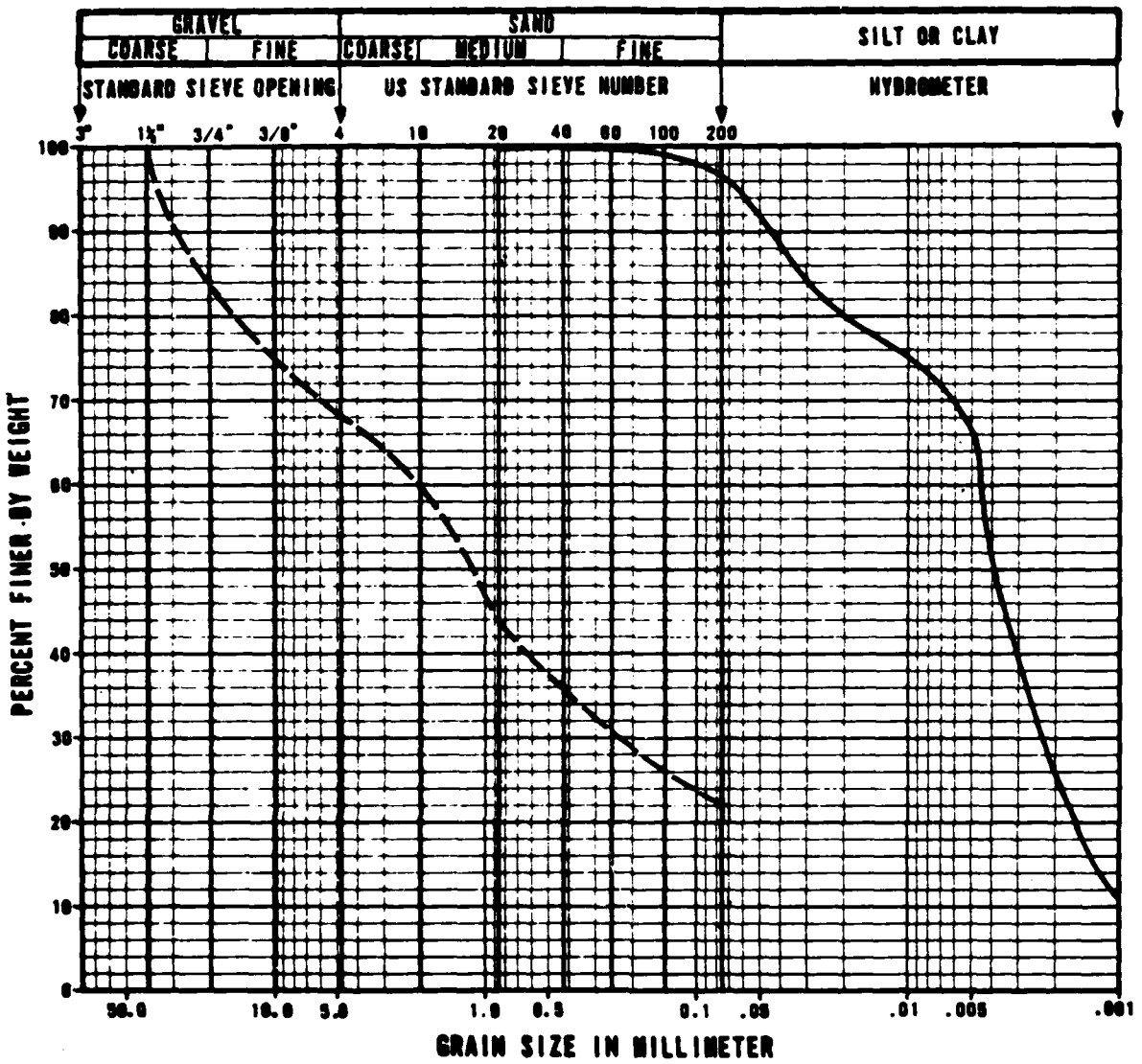
SYMBOL	COMPOSITE SAMPLE NUMBER	ACTIVITY NUMBER	SAMPLE INTERVAL		SOIL TYPE
			FEET	METERS	
———	A	DM-T-1	0.5 - 2.0	0.15 - 0.61	SM
—·—·—	B	DM-T-2	0.5 - 2.0	0.15 - 0.61	GW-GM
—··—··—	C	DM-T-4	0.5 - 1.5	0.15 - 0.46	SM
—···—···—	D	DM-T-6	0.5 - 2.0	0.15 - 0.61	SM

GRAIN-SIZE CURVES, CBR TESTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - [redacted]

FIGURE
II-8-2
1 OF 2

FUGRO NATIONAL, INC.



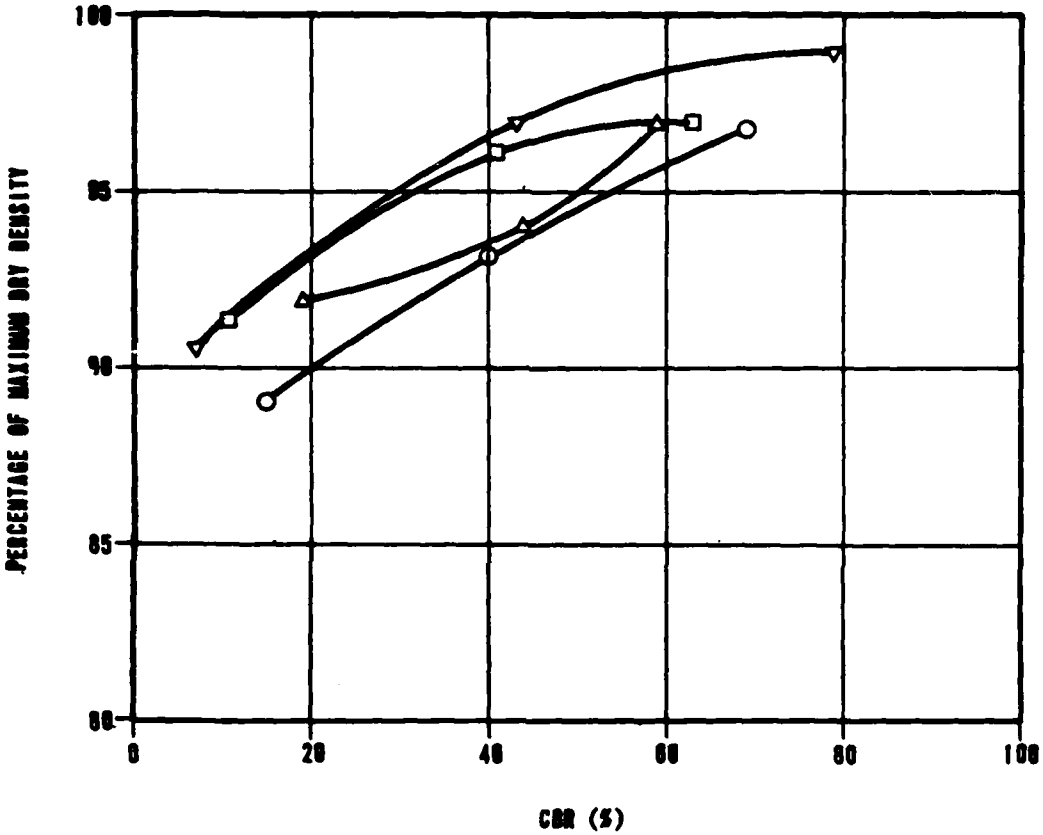
SYMBOL	COMPOSITE SAMPLE NUMBER	ACTIVITY NUMBER	SAMPLE INTERVAL		SOIL TYPE
			FEET	METERS	
——	E	DM-T-7	0.5–2.0	0.15–0.61	ML
— —	F	DM-T-8	0.5–2.0	0.15–0.61	SM

GRAIN-SIZE CURVES, CBR TESTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - [redacted]

FIGURE
II-8-2
2 OF 2

FUGRO NATIONAL, INC.



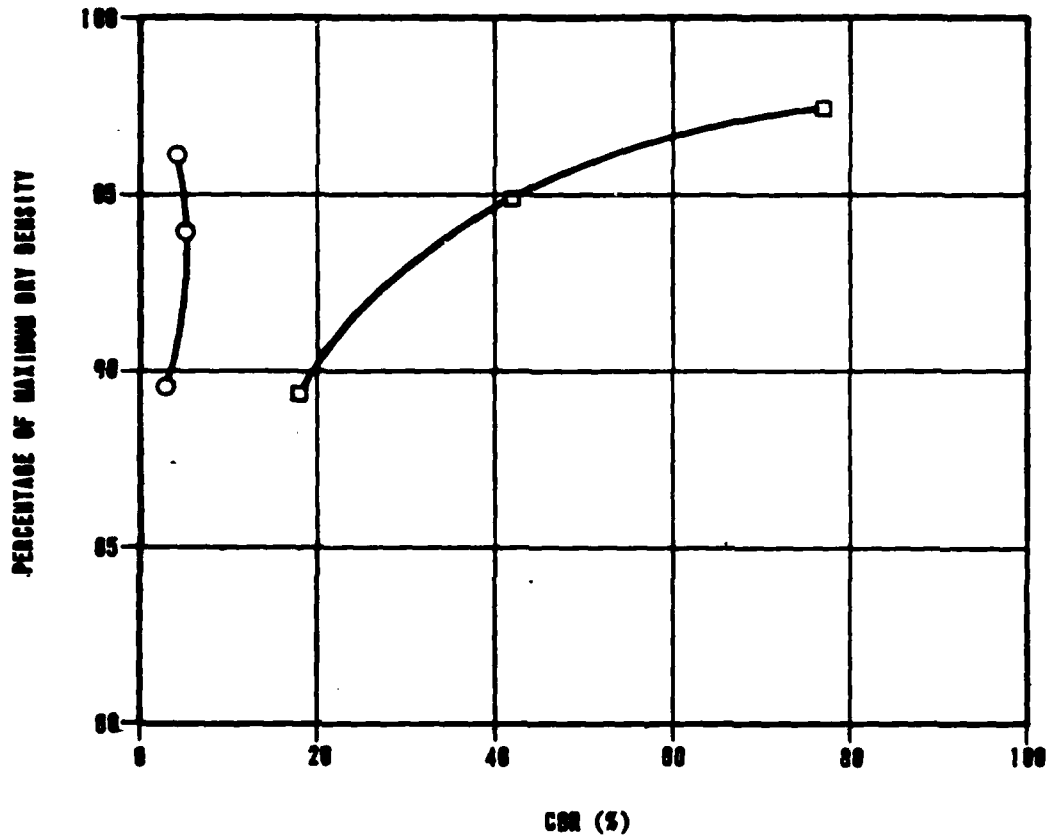
SYMBOL	COMPOSITE SAMPLE NUMBER	SOIL TYPE
○	A	SM
□	B	GW-GM
△	C	SM
▽	D	SM

CALIFORNIA BEARING RATIO (CBR) CURVES
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-8-3

FUGRO NATIONAL, INC.



SYMBOL	COMPOSITE SAMPLE NUMBER	SOIL TYPE
○	E	ML
□	F	SM

CALIFORNIA BEARING RATIO (CBR) CURVES
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-8-4

FUGRO NATIONAL, INC.

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT											
				STANDARD SIEVE OPENING							U S STANDARD SIEVE NO.				
				BLDRS.	COBBLES		GRAVEL				SAND				
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10	40	100	20
DM-B-1	P-1	0.8-1.2	0.24-0.37						100	89	82	72	55	41	34
	D-2	3.5-4.0	1.07-1.22												
	D-3	6.0-6.5	1.83-1.98							100	90	63	15	7	5
	D-4	9.0-9.5	2.74-2.90						100	90	76	54	27	15	9
	D-5	15.2-15.7	4.63-4.79						100	98	88	63	20	9	7
	D-6	20.3-20.8	6.19-6.34												
	D-7	25.3-25.8	7.71-7.86												
	P-8	30.8-31.6	9.39-9.63								100	94	23	6	3
	D-9	40.3-40.8	12.28-12.44												
	D-10	50.3-50.8	15.33-15.48						100	90	75	61	28	10	7
	D-11	60.3-60.8	18.38-18.53						100	97	88	64	29	11	8
	P-12	70.8-71.8	21.58-21.88												
	P-13	80.0-80.8	24.38-24.63												
	P-14	82.8-83.6	25.24-25.48						100	94	77	51	21	9	6
	P-15	90.8-91.6	27.68-27.92												
	D-16	99.2-99.7	30.24-30.39						100	98	86	60	20	10	8
DM-B-2	P-1	0.0-0.8	0.00-0.24							100	95	86	55	35	21
	D-2	3.2-3.9	0.98-1.19												
	D-3	6.1-6.8	1.86-2.07												
	D-4	8.2-8.9	2.50-2.71					100	92	78	65	45	17	9	7
	D-5	10.7-11.4	3.26-3.47												
	D-6	15.2-15.9	4.63-4.85						100	94	87	69	18	7	5
	D-8	25.8-26.0	7.86-7.92						100	91	81	61	15	6	4
	D-9	30.2-30.7	9.20-9.36												
	D-10	40.2-40.7	12.25-12.41						100	81	70	56	27	16	1
	D-11	50.1-50.5	15.27-15.39					100	87	62	49	37	17	9	7
	D-12	60.2-60.7	18.35-18.50					100	88	57	42	32	19	12	8
	D-13	70.3-70.8	21.43-21.58					100	83	65	56	49	31	17	1
	D-15	86.3-86.7	26.30-26.43					100	71	67	60	51	29	17	1
	D-16	99.2-99.7	30.24-30.39					100	80	70	55	41	21	12	
DM-B-3	P-1	0.8-1.8	0.24-0.55										100	99	
	P-1	0.8-1.8	0.24-0.55												
	P-2	3.8-4.6	1.16-1.40												
	P-3	7.3-7.9	2.23-2.41							100	98	92	61	34	
	P-4	9.0-9.9	2.74-3.02									100	95	85	
	P-4	9.0-9.9	2.74-3.02												
	P-5	14.1-14.6	4.29-4.45												
	P-5	14.7-15.4	4.48-4.69												
	P-5	14.8-15.3	4.51-4.66												
	P-5	15.5-16.0	4.72-4.88												
	P-6	20.2-20.7	6.16-6.31												

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

ATTERBERG LIMITS (b)			USCS (c)	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS
LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)		
			SM	90.5	1450	7.3	23.0	0.86				
			SW–SM	100.3	1607	7.3	28.9	0.68				
			SW–SM	106.3	1703	14.2	65.6	0.58				
			SW–SM	100.0	1602	12.0	47.5	0.68				
		NP	SW–SM	103.7	1661	11.4	49.2	0.63				
			SP	108.4	1737	12.3	60.2	0.55				
			SP	107.5	1722	13.3	63.2	0.57				
			SP	96.7	1549	16.5	64.5	0.66				2.58
			SP	110.4	1769	9.8	50.2	0.53				
			SP–SM	114.6	1836	7.1	40.8	0.47				
			SP–SM	102.4	1640	13.8	57.6	0.65				
			SP–SM	103.7	1661	15.9	68.9	0.63				
			SP–SM	108.5	1738	18.0	87.9	0.55				
		NP	SW–SM	112.6	1804	10.6	58.0	0.50				
			SW–SM	104.9	1680	17.8	79.2	0.61				
			SW–SM	106.3	1703	16.0	73.8	0.59				
		NP	SM									
			SM	109.2	1749	6.8	34.0	0.54				
			SW–SM	111.3	1783	11.1	58.2	0.51				
			SW–SM	117.1	1876	7.7	47.4	0.44				
			SW–SM	117.1	1876	6.2	38.4	0.44				
			SW–SM	108.4	1737	12.5	61.1	0.55				
			SW	111.6	1788	12.4	65.5	0.51				
			SW–SM	115.3	1847	6.8	40.1	0.46				
		NP	SW–SM	114.4	1833	10.2	58.5	0.47				
			GW–GM	118.8	1903	9.1	58.4	0.42				
		NP	GW–GM	121.0	1938	7.3	51.3	0.38				2.67
			GW–GM	120.8	1935	8.3	56.9	0.40				
			SP–SM	111.5	1786	12.3	67.7	0.48				2.64
			SW–SM	126.7	2030	8.0	65.4	0.33				
33	24	9	ML	80.6	1291	12.1	30.0	1.09				
			ML	89.1	1427	4.7	14.2	0.89				
			ML	77.3	1238	6.2	14.1	1.18				
		NP	SM	123.6	1980	5.0	37.6	0.36				
32	20	12	CL	101.6	1628	14.2	58.1	0.66				
			CL	105.6	1692	13.0	59.3	0.59				
			CL	98.8	1583	19.9	76.4	0.71				

COMPACTED MAXIMUM DRY DENSITY (pcf)	COMPACTED MAXIMUM DRY DENSITY (kg/m³)	OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
						*			
			2.58						
								*	
			2.67						
			2.64						
					*				
					*				
				*					
			2.68						
				*					
				*					
				*					

SUMMARY OF LABORATORY TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE
II-3-1
1 OF 4

FUGRO NATIONAL, INC.

AFV-01

1 13

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT										
				STANDARD SIEVE OPENING							U S STANDARD SIEVE N			
				BLDRS.	COBBLES		GRAVEL				SAND			
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10	40	100
DM-B-3	P-6	20.8-21.6	6.34-6.58											
	P-6	20.9-21.4	6.37-6.52											
	P-6	21.8-22.3	6.64-6.80											
	P-7	25.8-27.4	7.86-8.35											
	P-7	25.8-26.6	7.86-8.11											
	P-8	30.8-31.6	9.39-9.63											
	P-9	40.8-41.6	12.44-12.68										100	99
	P-10	50.8-51.6	15.48-1573											
	P-10	51.6-52.5	15.73-16.00											
	P-10	51.6-52.5	15.73-16.00											
	P-11	60.0-61.6	18.29-18.78											
	P-12	70.8-71.6	21.58-21.82											
	P-13	80.8-81.6	24.63-24.87											
	P-14	90.8-91.6	27.68-27.92											
	P-15	98.3-99.1	29.96-30.21											
DM-B-4	P-1	0.0-0.7	0.00-0.21						100	97	93	90	75	46
	D-3	5.5-6.0	1.68-1.83					100	89	71	55	41	23	15
	D-4	8.0-8.5	2.44-2.59							100	98	92	72	47
	D-5	11.0-11.5	3.35-3.51					100	82	75	68	63	53	36
	D-7	20.5-21.0	6.25-6.40					100	96	89	76	62	37	16
	D-8	25.3-25.8	7.71-7.86											
	D-9	30.3-30.8	9.24-9.39						100	97	88	70	30	12
	D-10	40.2-40.7	12.25-12.41											
	D-11	50.2-50.7	15.30-15.45											
	D-12	60.3-60.8	18.38-18.53						100	98	85	70	32	15
	D-13	70.2-70.7	21.40-21.55											
	D-14	84.3-84.8	25.69-25.85						100	93	86	79	62	36
	D-15	99.3-99.8	30.27-30.42						100	95	83	63	27	14
DM-B-5	P-1	0.8-1.6	0.24-0.49							100	98	92	65	48
	P-2	3.8-4.6	1.16-1.40											
	D-3	7.5-8.0	2.29-2.44						100	98	91	83	48	26
	D-4	10.5-11.0	3.20-3.35					100	92	78	66	47	17	7
	D-5	14.0-14.5	4.27-4.42							100	98	89	59	35
	D-6	20.2-20.9	6.16-6.37											
	D-7	25.1-25.8	7.65-7.86							100	96	80	31	22
	D-8	30.2-30.5	9.20-9.30						100	98	90	65	25	16
	D-8	30.5-30.9	9.30-9.42						100	99	98	95	79	56
	D-9	40.2-40.9	12.25-12.47						100	98	94	65	16	8
	D-10	50.5-51.2	15.39-15.61											
	D-11	60.2 60.9	18.35-18.56								100	98	47	17
	D-12	70.2-70.9	21.40-21.61											

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

FINER BY WEIGHT								ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			
	U S STANDARD SIEVE NO.					PARTICLE SIZE (mm)						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC
	SAND				SILT OR CLAY															
3/8"	4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)		
								46	26	20	CL	97.1	1556	22.6	83.2	0.74				
											CL	95.9	1536	22.3	79.7	0.76				
											CL	93.3	1495	21.2	71.1	0.81				
								41	23	18	CL	90.3	1447	15.3	47.7	0.87				
											CL	93.4	1496	14.0	47.1	0.80				
								41	26	15	ML	79.3	1270	21.0	50.5	1.12				
			100	99	98	75	37	46	24	22	CL	102.6	1644	21.5	91.5	0.63				2
								34	19	15	CL	99.1	1588	18.4	76.3	0.62				2
											CL	101.4	1624	15.8	70.0	0.58				
											CL	98.9	1584	15.5	64.3	0.62				
								46	22	24	CL	100.2	1605	23.8	94.6	0.68				
											CL	96.6	1548	24.1	87.3	0.75				
											CL	91.1	1459	28.8	91.6	0.85				
											CL	98.1	1572	24.9	93.9	0.72				
								48	24	24	CL	98.9	1584	23.7	90.9	0.70				
97	93	90	75	46	30					NP	SM	91.2	1461	2.7	8.5	0.85				
71	55	41	23	15	12						GW-GM	115.4	1849	4.0	23.7	0.46				
100	98	92	72	47	35						SM	97.1	1556	8.3	30.6	0.73				
75	68	63	53	36	25						SM	111.6	1788	5.6	29.7	0.51				
89	76	62	37	16	11						SP-SM	115.1	1844	10.1	58.8	0.46				
											SP-SM	119.6	1916	9.6	63.2	0.41				
97	88	70	30	12	8						SW-SM	111.6	1788	9.5	50.5	0.51				
											SW-SM	114.4	1833	6.5	37.3	0.47				
											SW-SM	119.2	1910	9.3	60.6	0.41				
98	85	70	32	15	10						SW-SM	119.6	1916	7.9	52.5	0.41				
											SW-SM	114.9	1841	9.8	56.5	0.47				
93	86	79	62	36	24					NP	SM	116.8	1871	9.3	57.0	0.44				
95	83	63	27	14	11						SW-SM	112.8	1807	7.6	41.8	0.49				
100	98	92	65	48	42			23	15	8	SC	92.9	1488	6.2	20.7	0.81				
											SM	107.7	1725	2.7	12.9	0.56				
98	91	83	48	26	20					NP	SM	110.2	1765	8.0	40.7	0.53				
78	66	47	17	7	5						SP-SM	104.8	1679	6.3	28.2	0.61				
00	98	89	59	35	22						SM	108.5	1738	7.1	34.7	0.55				
											SM	104.7	1677	12.8	56.7	0.61				
00	96	80	31	22	20						SM	106.6	1708	9.7	45.0	0.58				
98	90	65	25	16	14						SM	105.0	1682	12.7	56.7	0.61				
99	98	95	79	56	42						SM	100.1	1604	18.2	71.8	0.68				
98	94	65	16	8	6						SW-SM	106.9	1713	7.6	35.8	0.58				
											SW-SM	106.8	1711	7.3	34.1	0.58				

COMPACTED MAXIMUM DRY DENSITY (pcf)	COMPACTED MAXIMUM DRY DENSITY (kg/m³)	OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
				*					
				*					
					*				
			2.68						
			2.57						
					*				
							*		
						*			
						*			
						*			

SUMMARY OF LABORATORY TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE
II-8-1
2 OF 4

FUGRO NATIONAL, INC.

AFV-01

1 3

0.5–2.0	0.15–0.61					
4.0–5.0	1.22–1.52					
0.5–1.5	0.15–0.46					
0.5–2.0	0.15–0.61					
2.0–3.0	0.61–0.91					100
0.5–2.0	0.15–0.61					
0.5–2.0	0.15–0.61					
6.0–7.0	1.83–2.13					100
0.5–2.0	0.15–0.61					100
0.5–1.5	0.15–0.46					
0.5–2.0	0.15–0.61					100
3.0–4.0	0.91–1.22					
0.5–2.0	0.15–0.61					
3.0–4.0	0.91–1.22					100
0.5–1.5	0.15–0.46					
3.0–4.0	0.91–1.22					

		SM			
		SP			
	NP	SM			
25	10	ML			
		SW			
		SM			
		SP–SM			
		SM			
	NP	SM			
16	5	CL–ML			
		SW–SM			
14	6	SM–SC			

VOID RATIO	COMPACTED MAXIMUM DRY DENSITY (pcf)	COMPACTED MAXIMUM DRY DENSITY (kg/m³)	COMPACTED OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
0.62										
0.58										
	118.6	1900	12.5							*
	130.0	2083	8.1							*
	121.0	1938	10.5							*
	120.5	1930	10.5	2.60						*
	101.5	1626	22.5	2.66						*
	125.1	2004	10.0							*
									*	
									*	
									*	

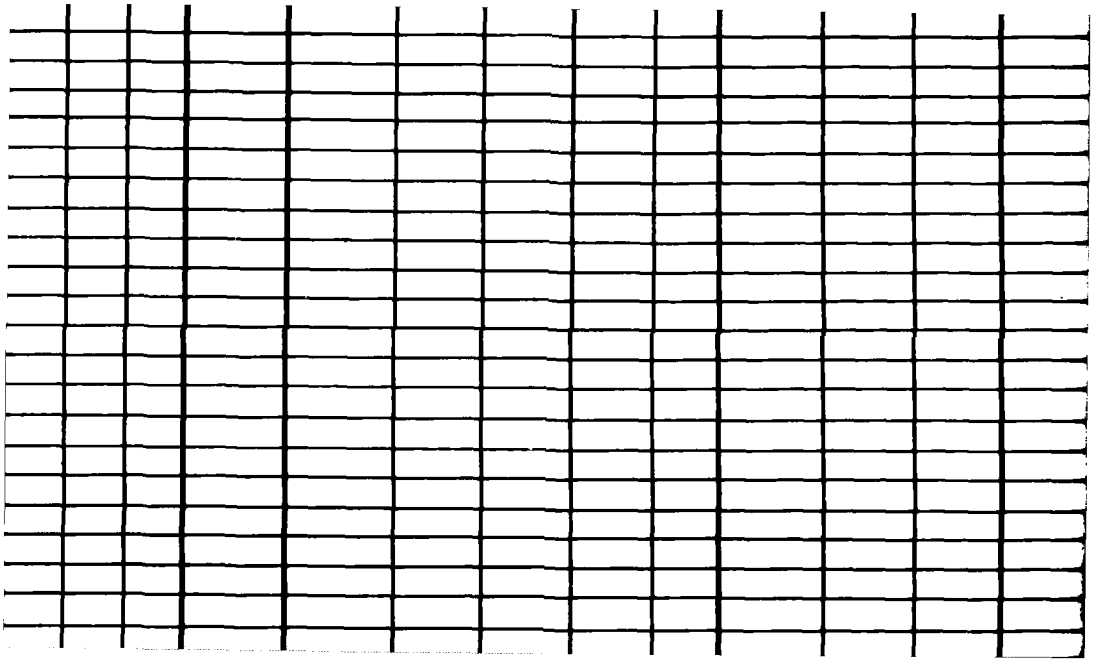
SUMMARY OF LABORATORY TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE
II-8-1
3 OF 4

FUGRO NATIONAL, INC.

AFV-01



…RATIO	COMPACTED MAXIMUM DRY DENSITY (pcf)	COMPACTED MAXIMUM DRY DENSITY (kg/m³)	COMPACTED OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
									*	

SUMMARY OF LABORATORY TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE
II-8-1
4 OF 4

FUGRO NATIONAL, INC.

AFV-01

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	TYPE OF TEST	DRY DENSITY		MOISTURE CONTENT (%)	CONFINING PRESSURE (σ_3)		MAXIMUM DEVIATOR STRESS ($\sigma_1-\sigma_3$)		STRAIN RATE (%/min)	BACK PRESSURE	
		FEET	METERS			pcf	kg/m³		ksf	kN/m²	ksf	kN/m²		ksf	kN/m²
DM-B-3	P-5	14.8 - 15.3	4.51 - 4.66	CL	CD	100.3	1607	19.7	1.0	48	10.5	503	0.02	0	0
	P-5	14.1 - 14.6	4.51 - 4.66	CL	CD	98.8	1583	19.9	1.5	72	13.2	632	0.02	0	0
	P-5	15.5 - 16.0	4.72 - 4.88	CL	CD	98.2	1573	20.4	2.0	96	15.0	718	0.02	0	0
DM-B-3	P-6	21.8 - 22.3	6.64 - 6.80	CL	CD	93.3	1495	21.2	2.0	96	19.1	915	0.02	0	0
	P-6	20.2 - 20.7	6.16 - 6.31	CL	CD	94.4	1512	22.8	3.0	144	15.8	757	0.02	0	0
	P-6	20.9 - 21.4	6.37 - 6.52	CL	CD	95.9	1536	22.3	4.0	192	19.3	924	0.02	0	0

SUMMARY OF TRIAXIAL COMPRESSION TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-8-2

FUGRO NATIONAL, INC.

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	UNCONFINED COMP. STRENGTH		DRY DENSITY		MOISTURE CONTENT (%)	DEGREE OF SATURATION (%)	HEIGHT/ DIAMETER
		FEET	METERS		ksf	kN/m²	pcf	kg/m³			
DM-B-3	P-1	0.8 - 1.8	0.24 - 0.55	ML	0.7	34	89.1	1427	4.7	14.2	2.09
	P-4	9.0 - 9.9	2.74 - 3.02	CL	13.6	651	105.6	1692	13.0	59.3	2.09
	P-7	26.8 - 26.6	7.86 - 8.11	CL	5.9	282	93.4	1496	14.0	47.1	2.09
	P-10	51.6 - 52.5	15.73 - 16.00	CL	9.9	474	101.4	1624	15.8	70.0	2.09

SUMMARY OF UNCONFINED COMPRESSION TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - USAF

TABLE II-8-3

FUGRO NATIONAL, INC.

24 MAR 81

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	NORMAL STRESS		MAXIMUM SHEAR STRENGTH	
		FEET	METERS		ksf	kN/m²	ksf	kN/m²
DM-B-1	D-5	15.2 - 15.7	4.63 - 4.79	SW-SM	1.5	72	2.58	124
					2.3	110	3.55	170
					3.0	144	4.20	201
DM-B-4	D-7	20.5 - 21.0	6.25 - 6.40	SP-SM	2.0	96	2.85	136
					3.0	144	3.48	167
					4.0	192	4.71	226
DM-B-5	D-5	14.0 - 14.5	4.27 - 4.42	SM	1.5	72	1.97	94
					2.3	110	2.63	126
					3.0	144	3.47	166
DM-B-5	D-9	40.2 - 40.9	12.25 - 12.47	SW-SM	4.0	192	3.95	189
					6.0	287	6.42	307
					8.0	383	8.22	394

DIRECT SHEAR TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE
II-B-4

FUGRO NATIONAL, INC.

ACTIVITY NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	pH	WATER SOLUBLE				CALCIUM CARBONATE
		FEET	METERS			SODIUM	CHLORIDE	SULPHATE	CALCIUM	
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
DM-B-2	D-9	30.2 - 30.7	9.20 - 9.36	SW-SM	7.2	16	90	55	63	211
DM-P-2	b-2	3.0 - 4.0	0.91 - 1.22	SP-SM	8.6	20	70	32	60	260
DM-P-7	b-1	0.5 - 2.0	0.15 - 0.61	SM	8.5	5	25	19	66	188
DM-P-13	b-1	0.5 - 2.0	0.15 - 0.61	ML	7.7	295	322	97	633	1960
DM-CS-24	B-1	0.5 - 2.0	0.15 - 0.61	CL-ML	7.7	254	334	66	996	2800

SUMMARY OF CHEMICAL TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - [illegible]

TABLE II-8-5

FUGRO NATIONAL, INC.

COMPOSITE SAMPLE NUMBER	SOIL TYPE	PERCENT PASSING #200	ATTERBERG LIMITS		SPECIFIC GRAVITY	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	COMPACTED DRY DENSITY		COMPACTED MOISTURE (%)	PERCENT OF MAXIMUM DRY DENSITY	CBR (%)
			LL	PI		pcf	kg/m³		pcf	kg/m³			
A	SM	28		NP		118.6	1900	12.5	114.7	1837	12.7	96.8	69
									110.5	1772	12.6	93.2	40
									105.7	1693	12.5	89.1	15
B	GW-GM	12				130.0	2083	8.1	126.3	2023	8.0	97.1	63
									125.0	2003	7.7	96.2	41
									118.8	1903	8.7	91.4	11
C	SM	16				121.0	1938	10.5	117.2	1876	11.5	96.9	59
									113.7	1821	12.6	94.0	44
									110.9	1777	10.0	91.6	19
D	SM	28		NP	2.60	120.5	1930	10.5	119.2	1911	10.2	99.0	79
									116.9	1873	10.2	97.0	43
									109.1	1748	10.5	90.6	7

CALIFORNIA BEARING RATIO (CBR)
TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - [redacted]

TABLE II-8-6
1 OF 2

FUGRO NATIONAL, INC.

COMPOSITE SAMPLE NUMBER	SOIL TYPE	PERCENT PASSING #200	ATTERBERG LIMITS		SPECIFIC GRAVITY	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	COMPACTED DRY DENSITY		COMPACTED MOISTURE (%)	PERCENT OF MAXIMUM DRY DENSITY	CBR (%)
			LL	PI		pcf	kg/m³		pcf	kg/m³			
E	ML	97	35	10	2.69	101.5	1626	22.5	95.4	1530	22.1	94.0	5
									97.6	1564	22.3	96.1	4
									91.0	1456	22.7	89.7	3
F	SM	22				125.1	2004	10.0	121.9	1953	9.7	97.4	77
									118.8	1903	10.1	94.9	42
									111.8	1791	10.3	89.4	18

CALIFORNIA BEARING RATIO (CBR)
TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - [redacted]

TABLE II-8-6
2 OF 2

FUGRO NATIONAL, INC.

9.0 EXPLANATION OF CONE PENETROMETER TEST RESULTS

The results of all cone penetrometer tests are presented in this section. Explanations of the test results are as follows:

A. Depth - Corresponds to depth below ground surface.

B. Friction Resistance - The resistance to penetration developed by the friction sleeve, equal to the vertical force applied to the sleeve divided by its surface area. This resistance is the sum of friction and adhesion.

C. Cone Resistance - The resistance to penetration developed by the cone, equal to the vertical force applied to the cone divided by its horizontally projected area.

D. Friction Ratio - The ratio of friction resistance to cone resistance.

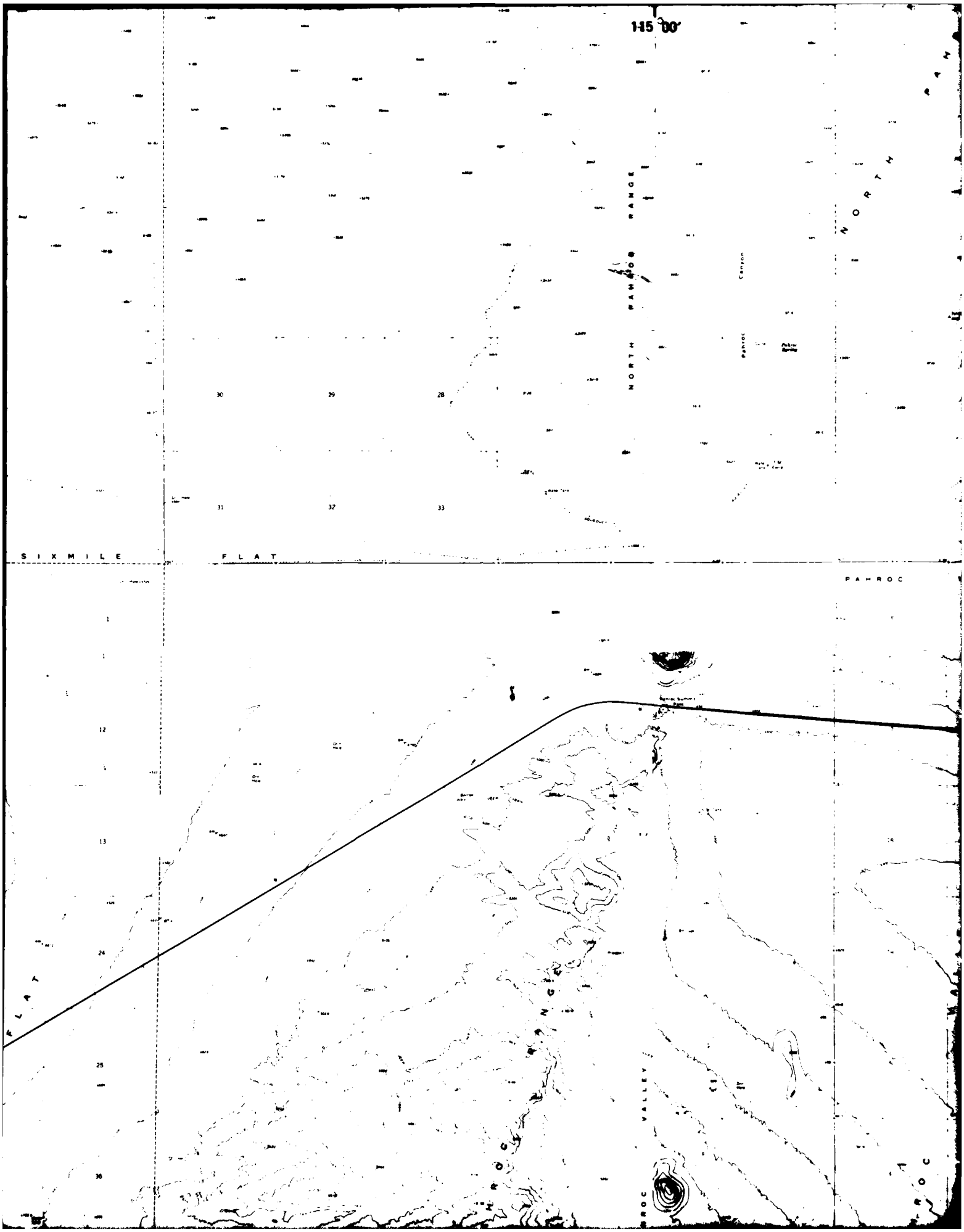
E. Designation - Each cone penetrometer test is identified by a number: for example C-1.

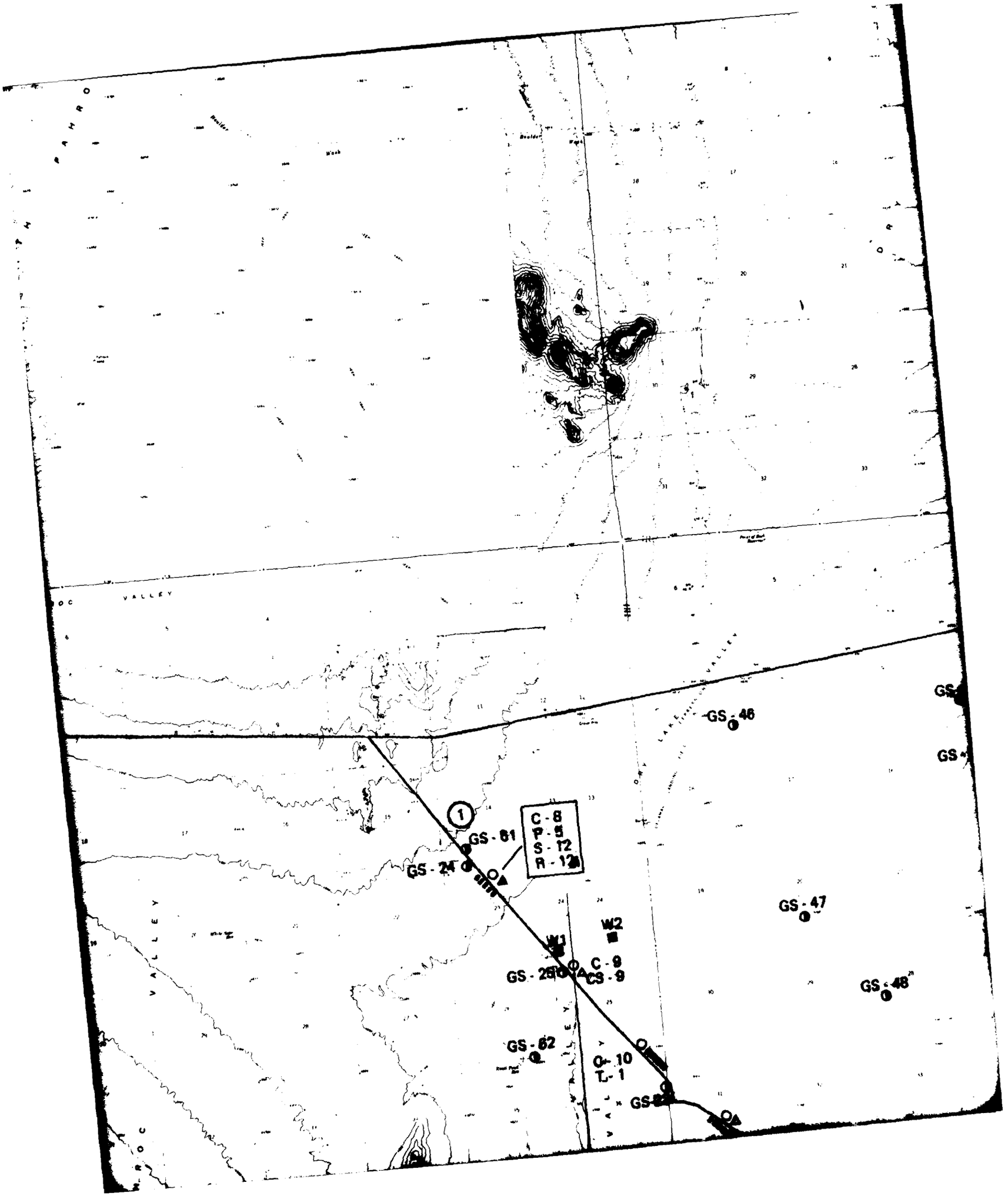
C - abbreviation for the CPT
1 - number of the test

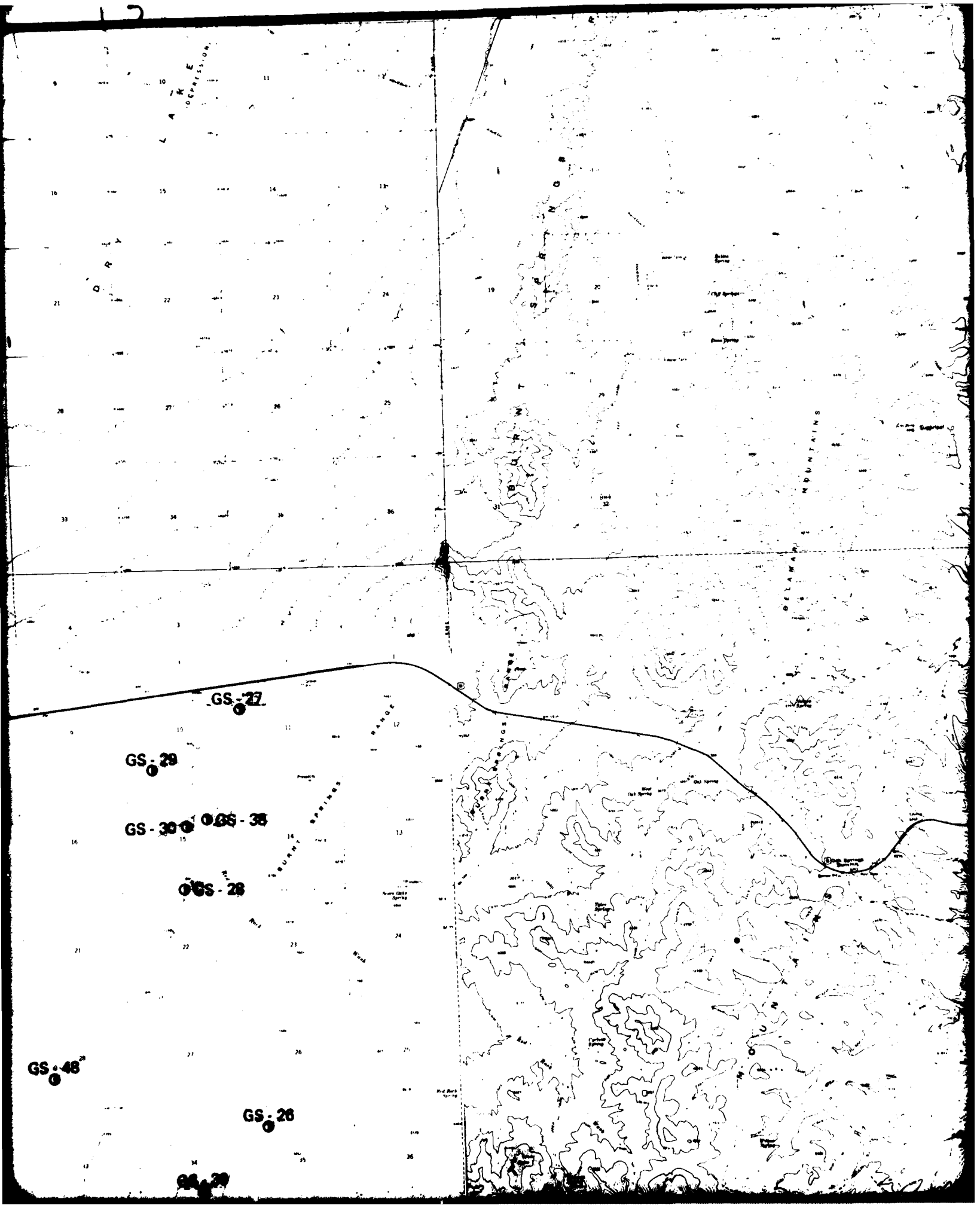
F. Surface Elevation - Indicated elevations on the drawings are estimated from topographic maps of the study area and are accurate within one-half the contour interval.

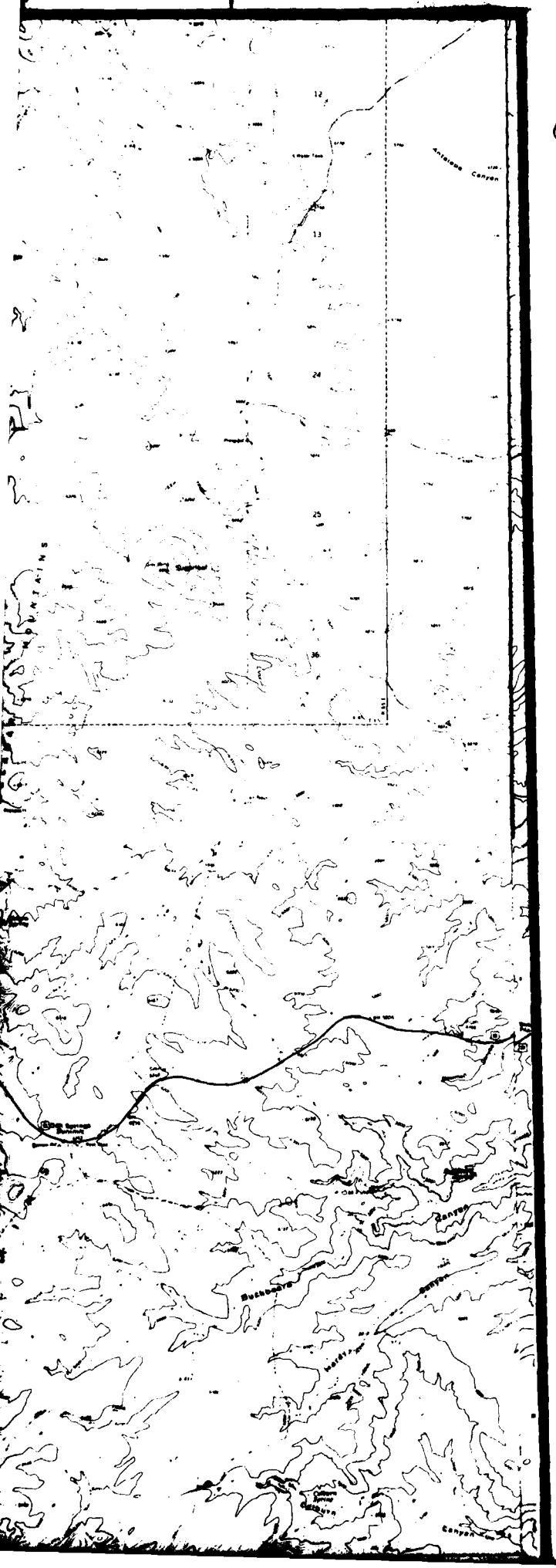
G. Surficial Geologic Unit - Indicates the surficial geologic unit in which the test was located.

H. Soil Column - A graphical presentation of the soil type versus depth at each cone penetrometer test location. The Unified Soil Classification Symbol for each different soil type is listed immediately to the left of the soil column. Immediately below the soil column, the activity number for the corresponding boring, trench, test pit, or surficial soil sample at each CPT location is given.


115°00'
NORTH PAHROC RANGE
NORTH
Pahroc Canyon
30
29
28
31
32
33
SIXMILE FLAT
PAHROC
1
12
13
24
25
36
FLAT
VALLEY

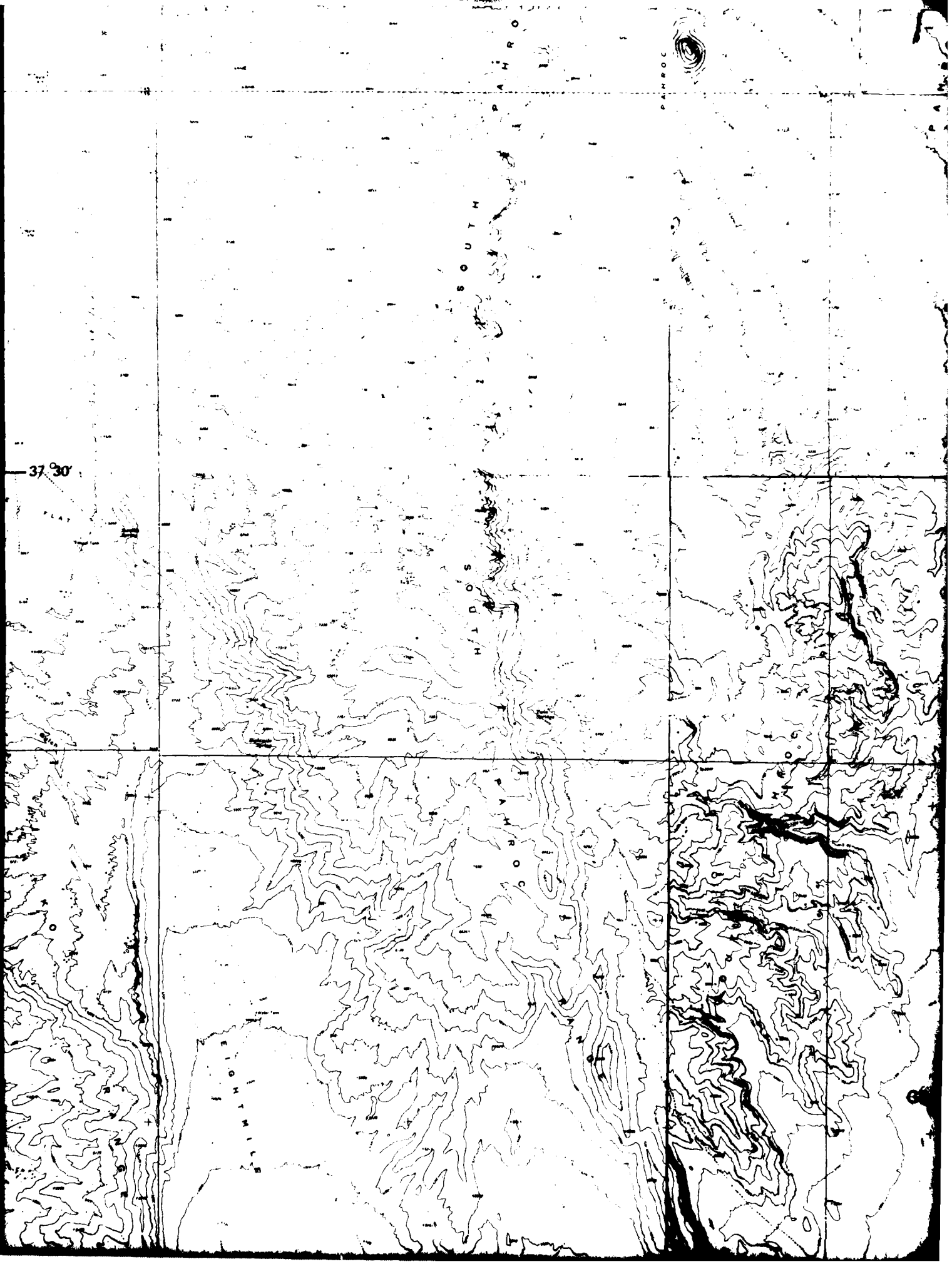

VALLEY
GS - 46
GS - 47
GS - 48
GS - 61
GS - 24
C - 8
P - 5
S - 12
R - 12
W2
W1
C - 9
GS - 25
CS - 9
GS - 62
C - 10
T - 1
GS - 8

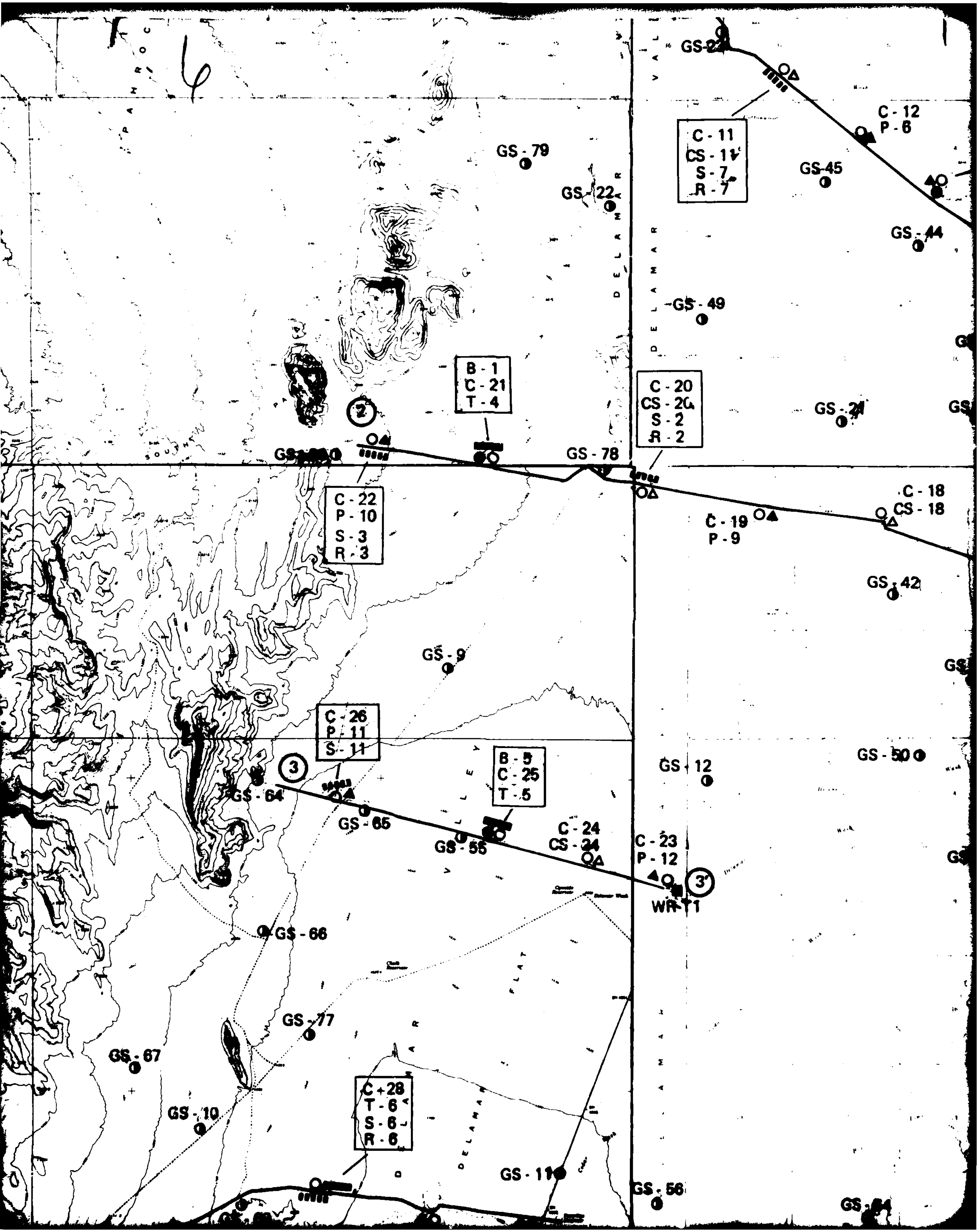

GS - 27
GS - 29
GS - 30
GS - 38
GS - 28
GS - 48
GS - 26
GS - 29
DELAWARE MOUNTAINS
BURNT SPRINGS RANGE

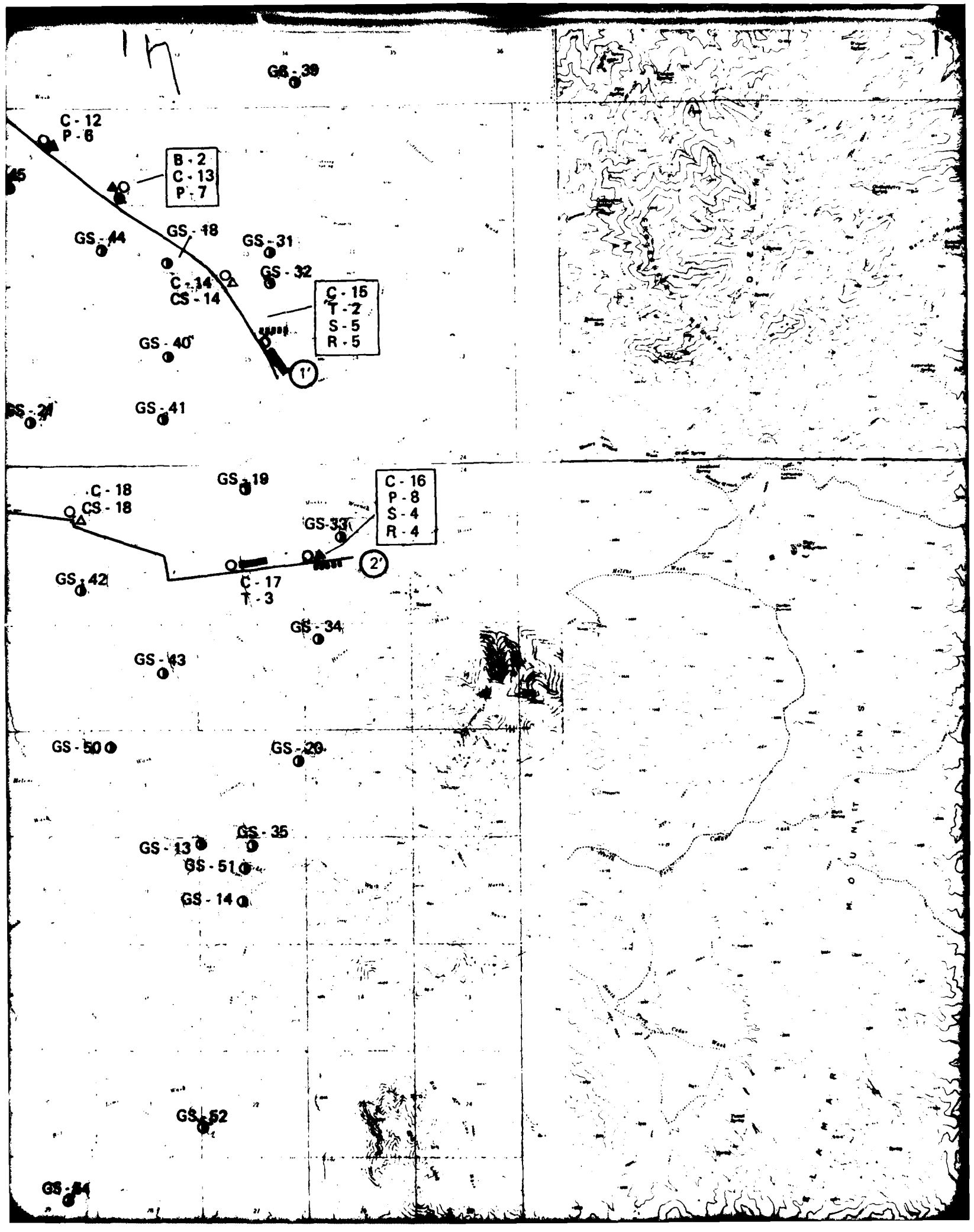


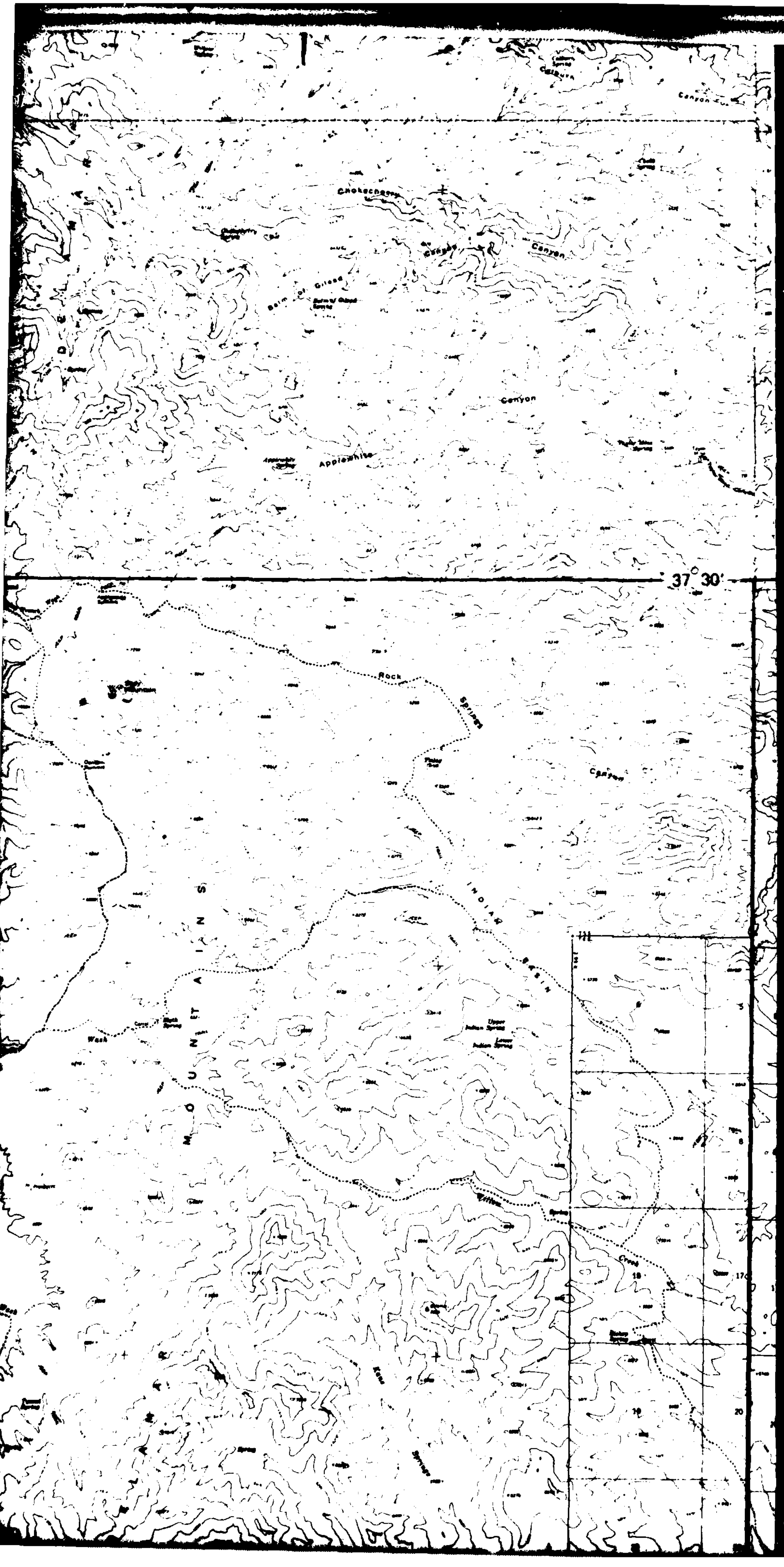
4

5



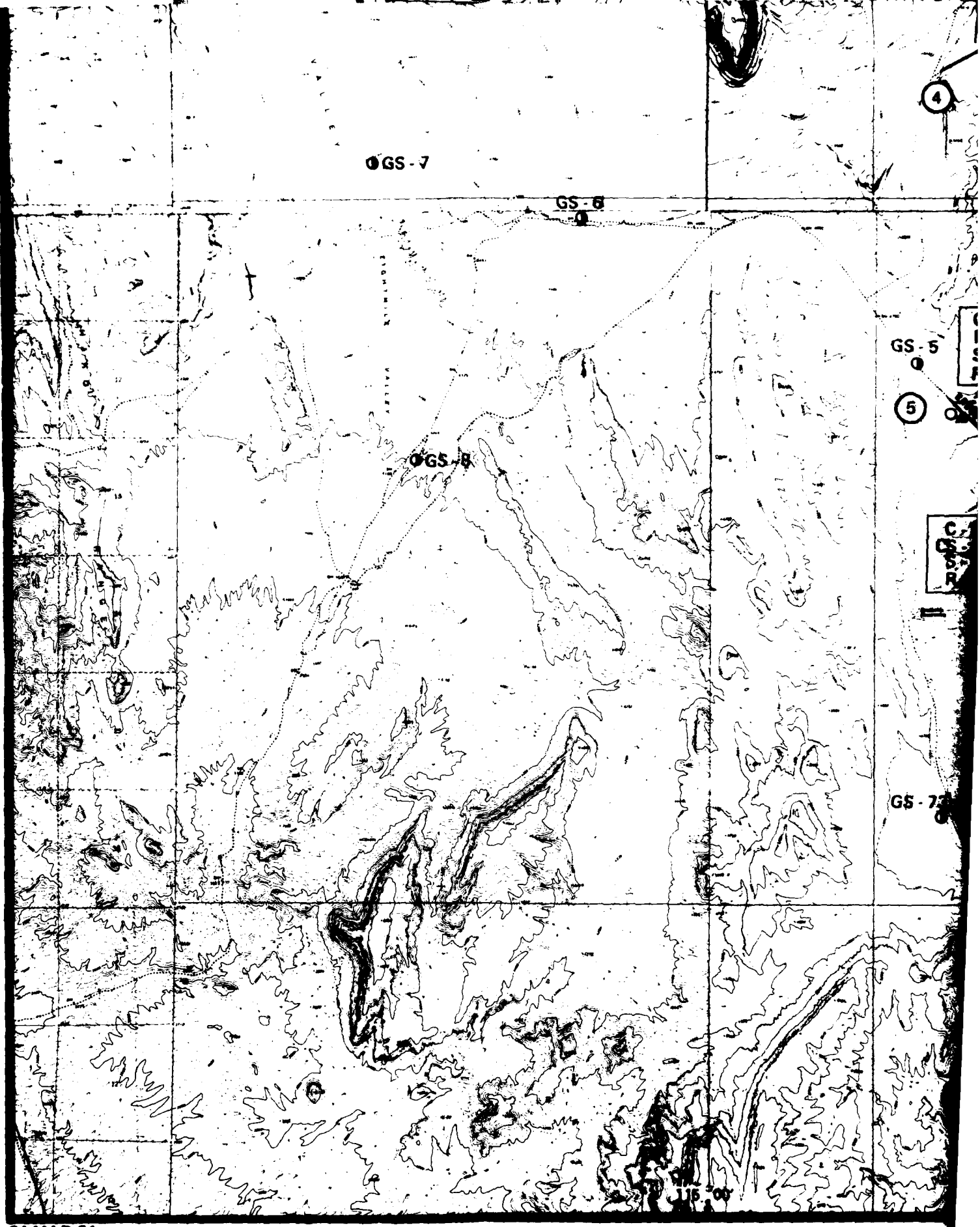

GS-23
C - 11
CS - 11
S - 7
R - 7
C - 12
P - 6
GS - 79
GS - 22
GS-45
GS - 44
DELAMAR
GS - 49
B - 1
C - 21
T - 4
C - 20
CS - 20
S - 2
R - 2
2
GS - 21
GS - 78
C - 22
P - 10
S - 3
R - 3
C - 19
P - 9
C - 18
CS - 18
GS - 42
GS - 9
C - 26
P - 11
S - 11
3
B - 5
C - 25
T - 5
GS - 12
GS - 50
GS - 64
GS - 65
GS - 55
C - 24
CS - 24
C - 23
P - 12
3'
WR-T1
GS - 66
GS - 77
GS - 67
C - 28
T - 6
S - 6
R - 6
GS - 10
GS - 11
GS - 56
FLAT
DELAMAR
VALLEY


GS - 39
C - 12
P - 6
B - 2
C - 13
P - 7
GS - 44
GS - 18
GS - 31
GS - 32
C - 14
CS - 14
C - 15
T - 2
S - 5
R - 5
GS - 40
1'
GS - 41
GS - 19
C - 18
CS - 18
C - 16
P - 8
S - 4
R - 4
GS - 33
2'
GS - 42
C - 17
T - 3
GS - 34
GS - 43
GS - 50
GS - 20
GS - 35
GS - 13
GS - 51
GS - 14
GS - 52
GS - 54

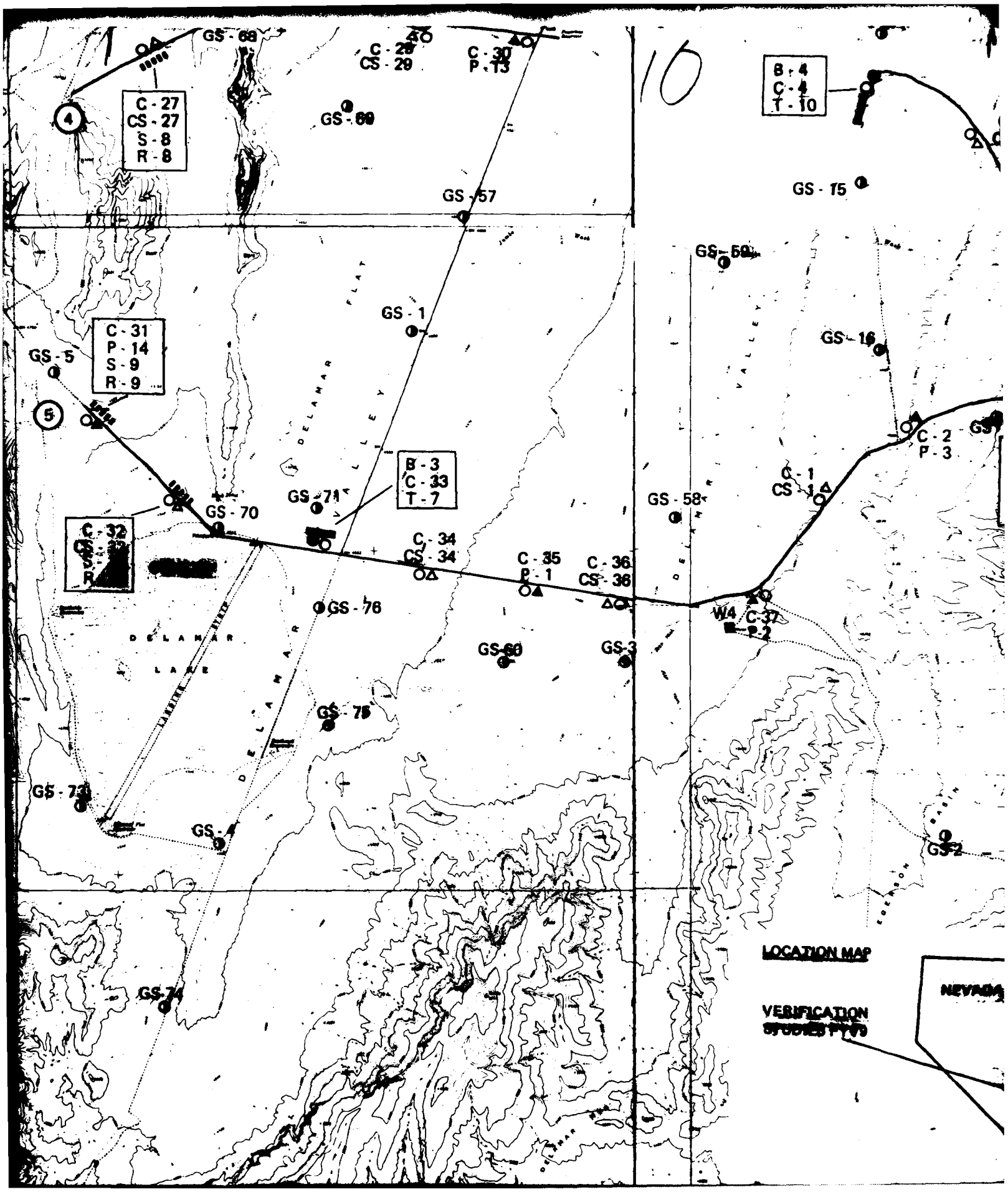

Chokecherry
Canyon
Canyon
Applewhite
37° 30'
Rock
Springs
Canyon
Wash

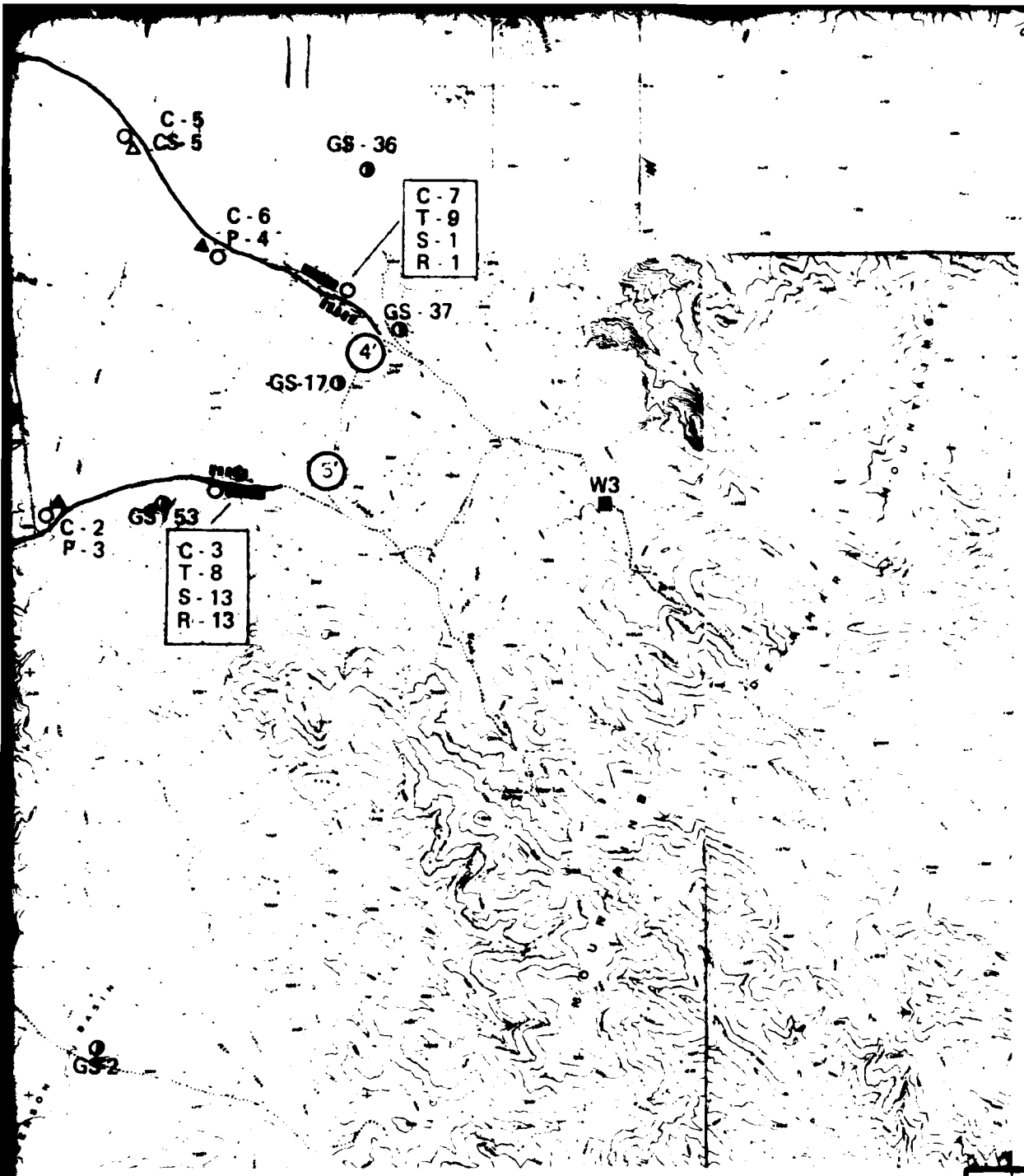
-8

9



24 MAR 81

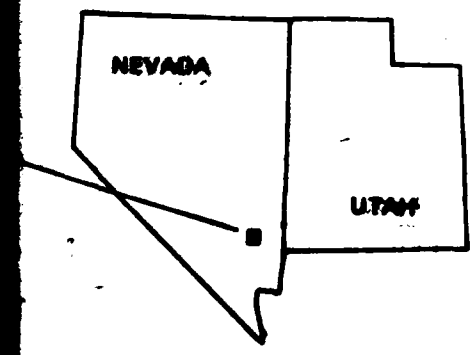

GS - 68
C - 28
CS - 29
C - 30
P - 13
C - 27
CS - 27
S - 8
R - 8
GS - 69
GS - 57
B - 4
C - 4
T - 10
GS - 15
GS - 59
GS - 1
GS - 5
C - 31
P - 14
S - 9
R - 9
GS - 16
C - 2
P - 3
B - 3
C - 33
T - 7
GS - 71
GS - 70
GS - 58
C - 1
CS - 1
C - 32
C - 34
CS - 34
C - 35
P - 1
C - 36
CS - 36
GS - 76
W4
C - 37
P - 2
GS - 60
GS - 3
GS - 75
GS - 73
GS - 4
GS - 2
GS - 74
DELAMAR FLAT
DELAMAR VALLEY
DELAMAR LAKE
LOCATION MAP
VERIFICATION
STUDIES FY89
NEVADA



EXPLANAT

◑	GS-1	GEOLOG
■	W1 WR	GROUND
●	B-1	BORING
○	C-1	CONE PE
△	CS-1	SURFAC
▬	T-1	TRENCH
▲	P-1	TEST PIT
▪▪▪▪▪	S-1	SEISMIC
	R-1	ELECTR
(1)–(1')		ACTIVIT

NOTE: Due to the exaggera of any combination or the CPT (Cone) is located nearest the



1" = 1 MILE

ACTIVITY L
DELAMA

MX SITING INVEST
DEPARTMENT OF THE A

FUGRO NA

12

EXPLANATION

◑	GS-1	GEOLOGIC STATION
■	W1 WR	GROUND WATER LEVEL MEASUREMENT
●	B-1	BORING
○	C-1	CONE PENETROMETER TEST (CPT)
△	CS-1	SURFACE SAMPLE AT CPT LOCATION
▬	T-1	TRENCH
▲	P-1	TEST PIT
▪▪▪▪▪	S-1	SEISMIC REFRACTION LINE
	R-1	ELECTRICAL RESISITIVITY LINE
(1)=(1')		ACTIVITY LINE

NOTE: Due to the exaggeration of the map symbols, the exact location of any combination of activities in which either the boring (bit) or the CPT (tip) is situated. Single activities are most accurately located nearest the center of the symbol.

ACTIVITY LOCATION MAP
DELAMAR, NEVADA

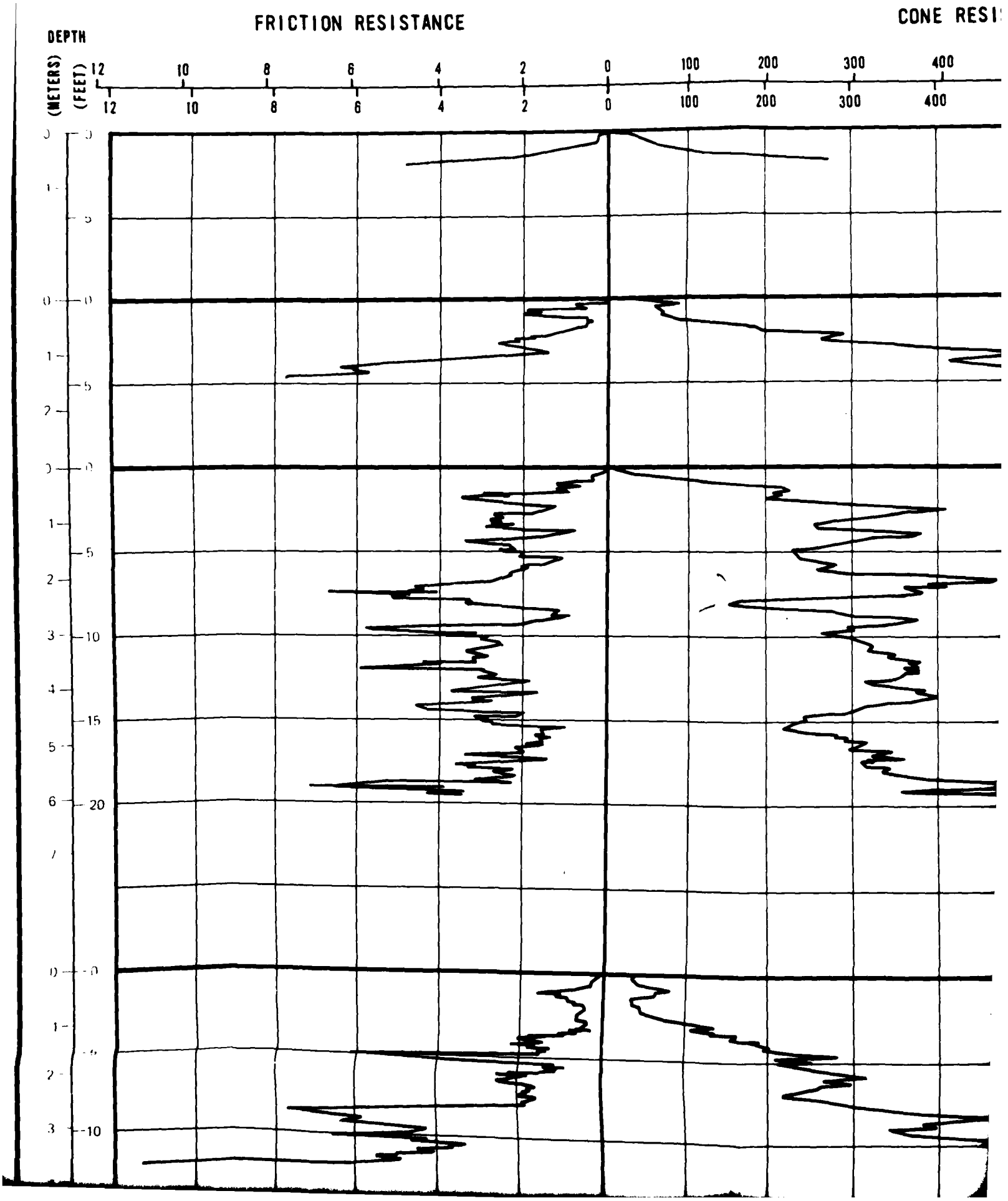
MX SITING INVESTIGATION

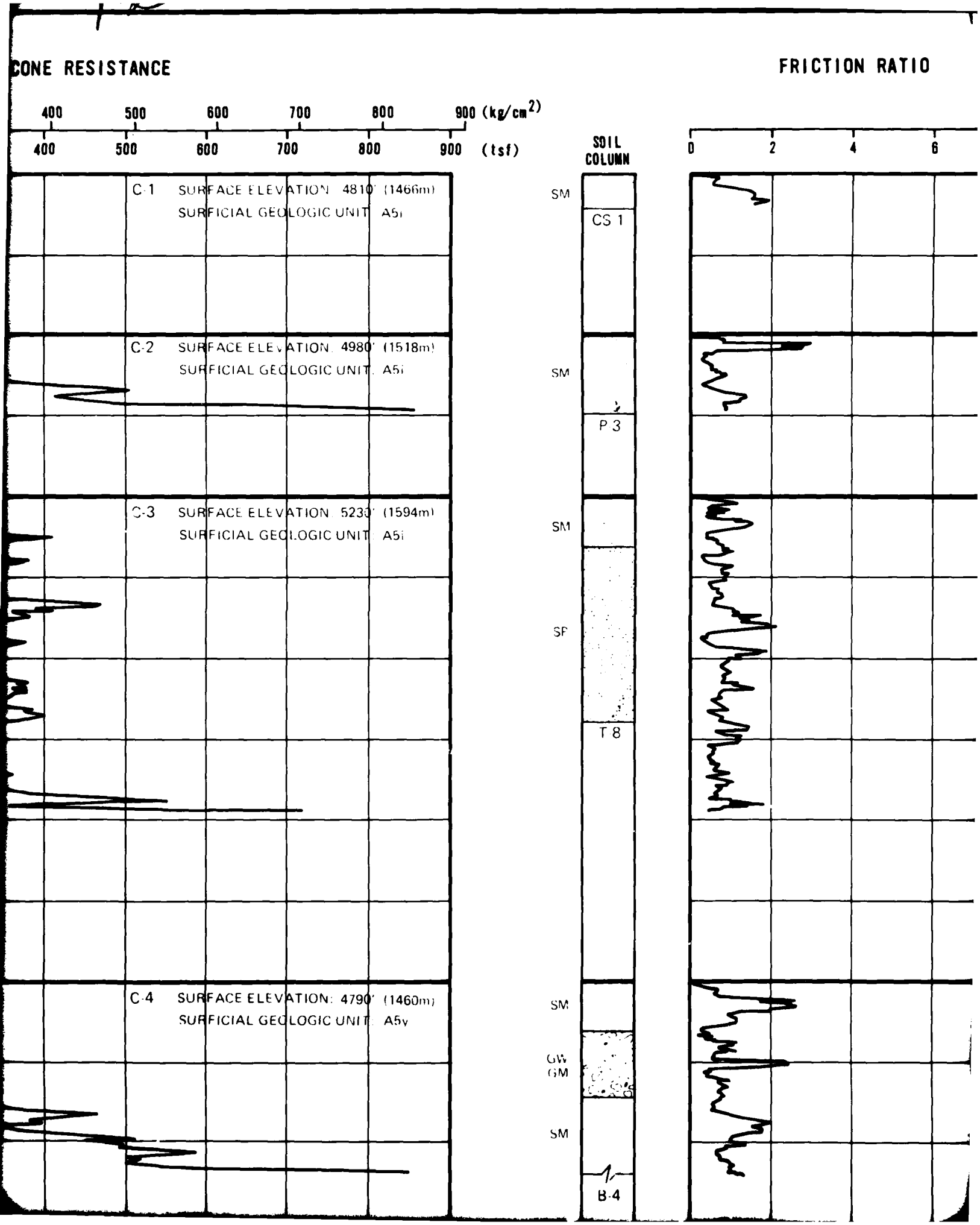
DEPARTMENT OF THE AIR FORCE – BMO

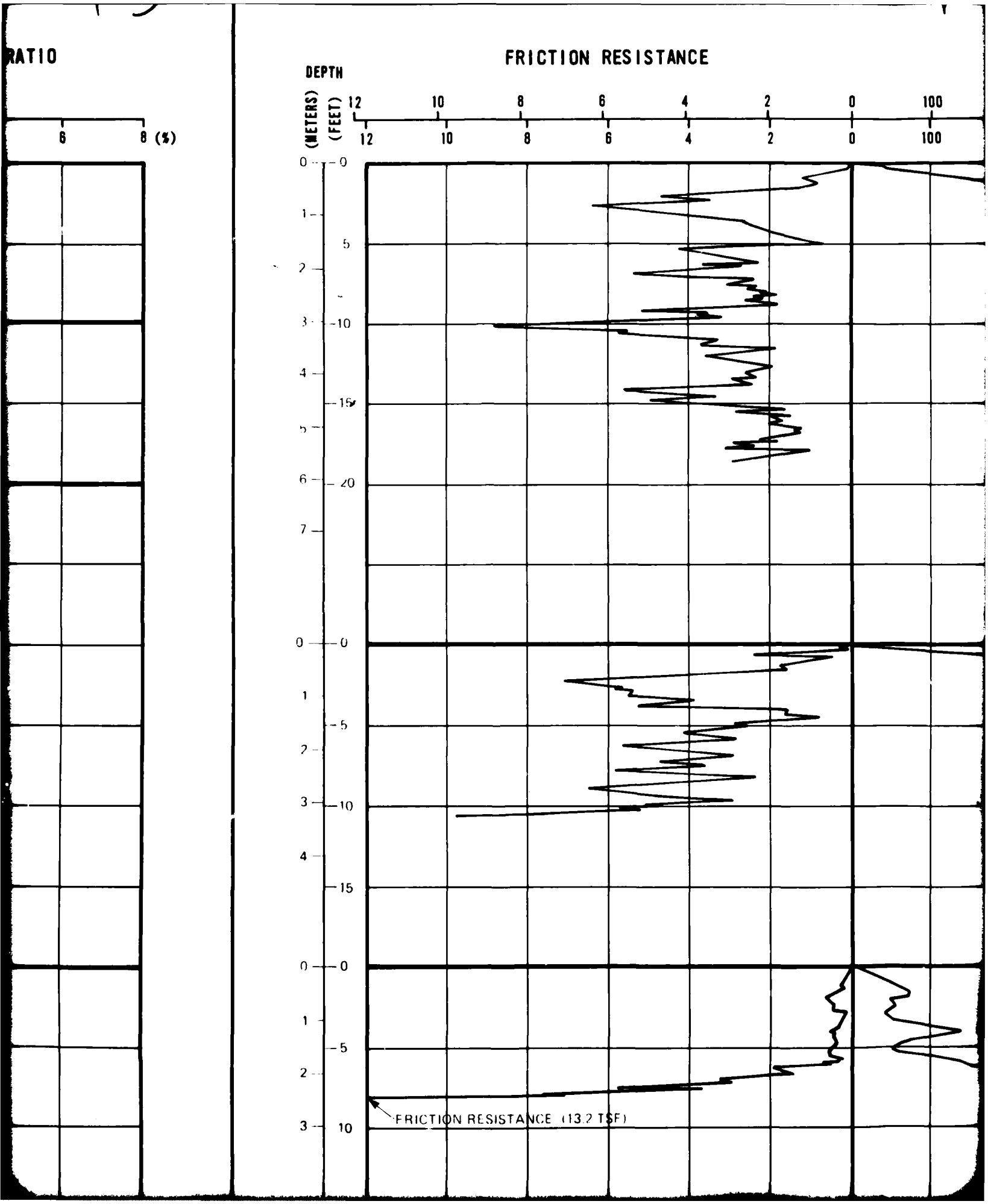
DRAWING

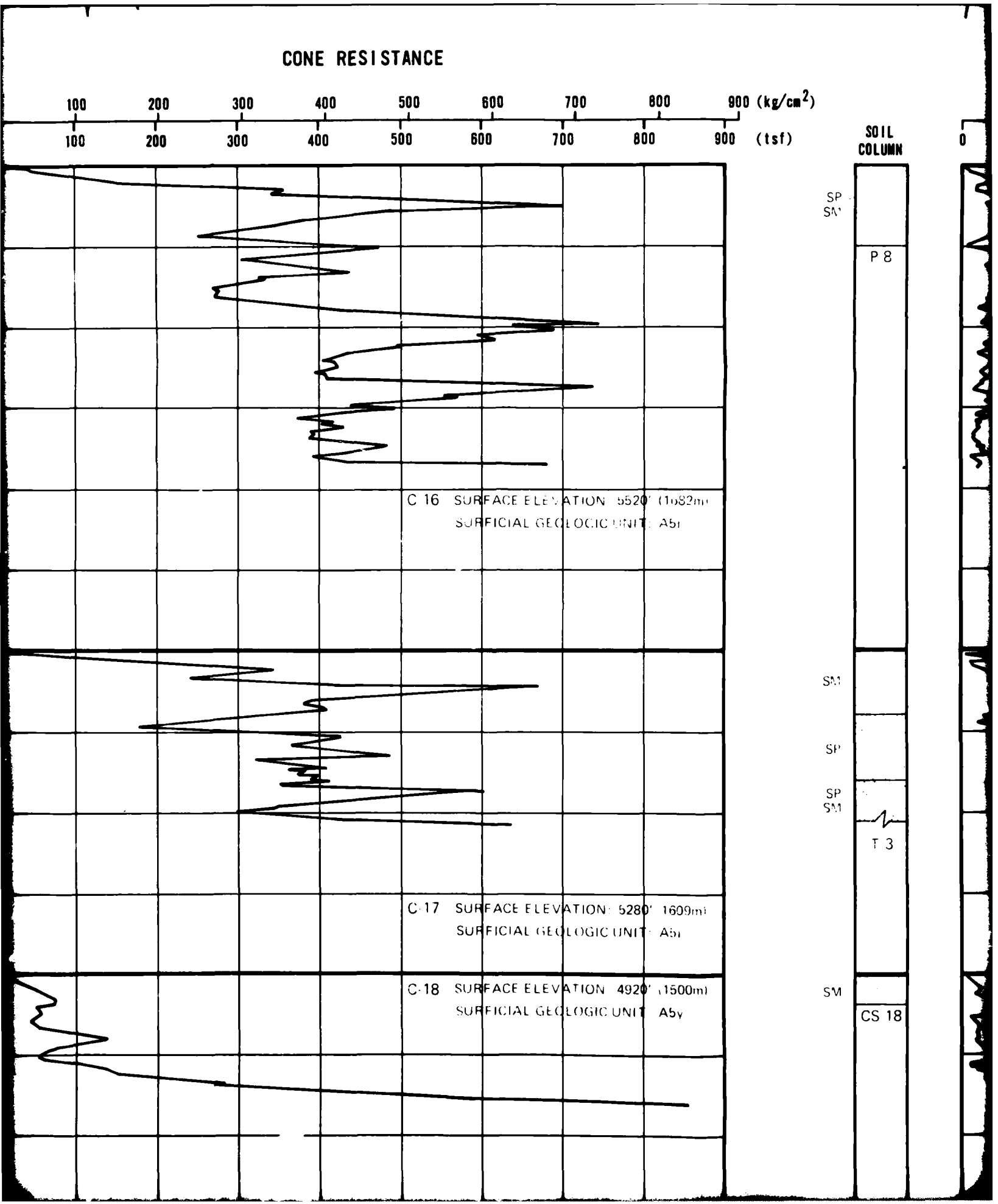
II-1-1

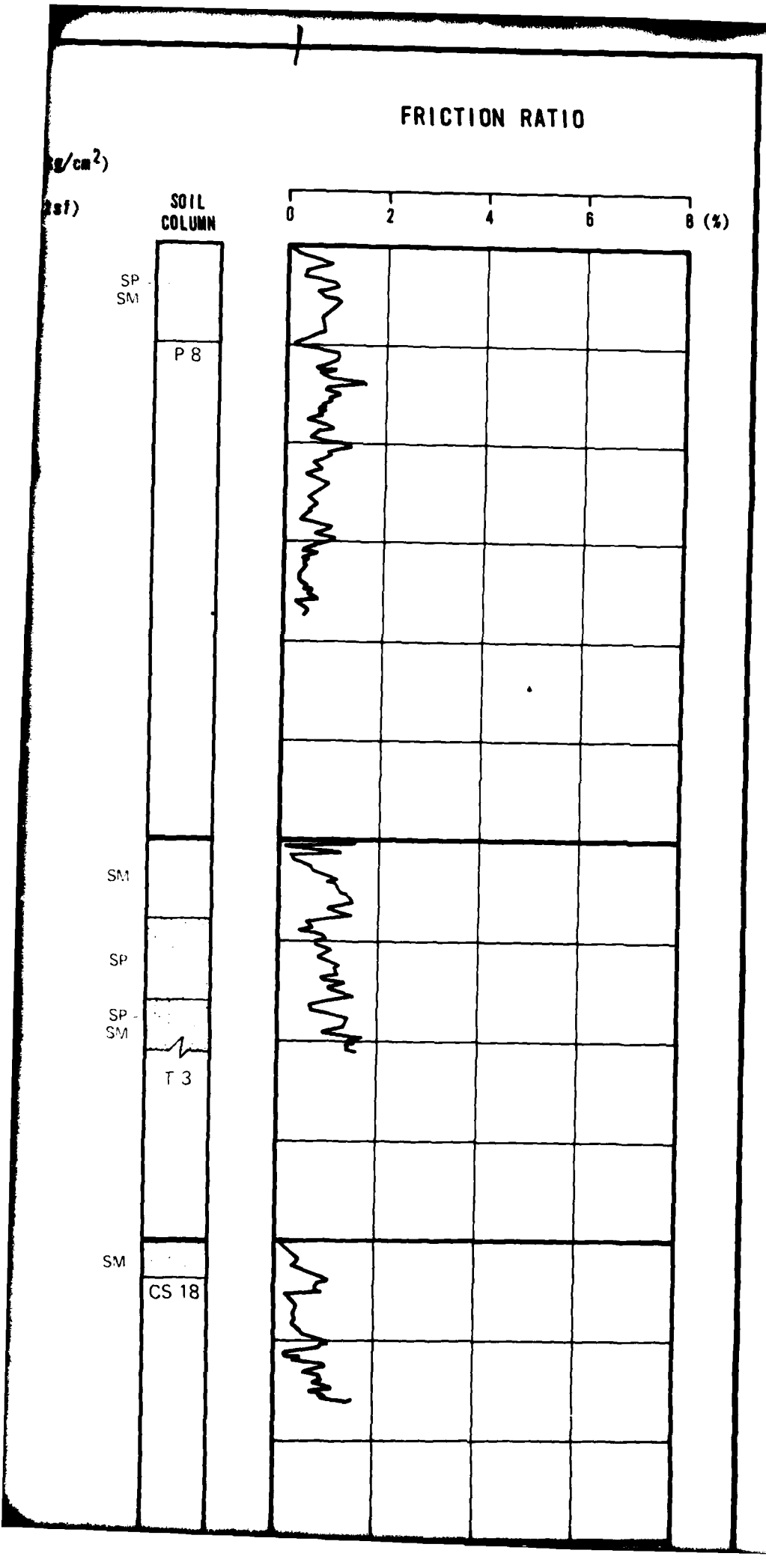
ERO NATIONAL, INC.

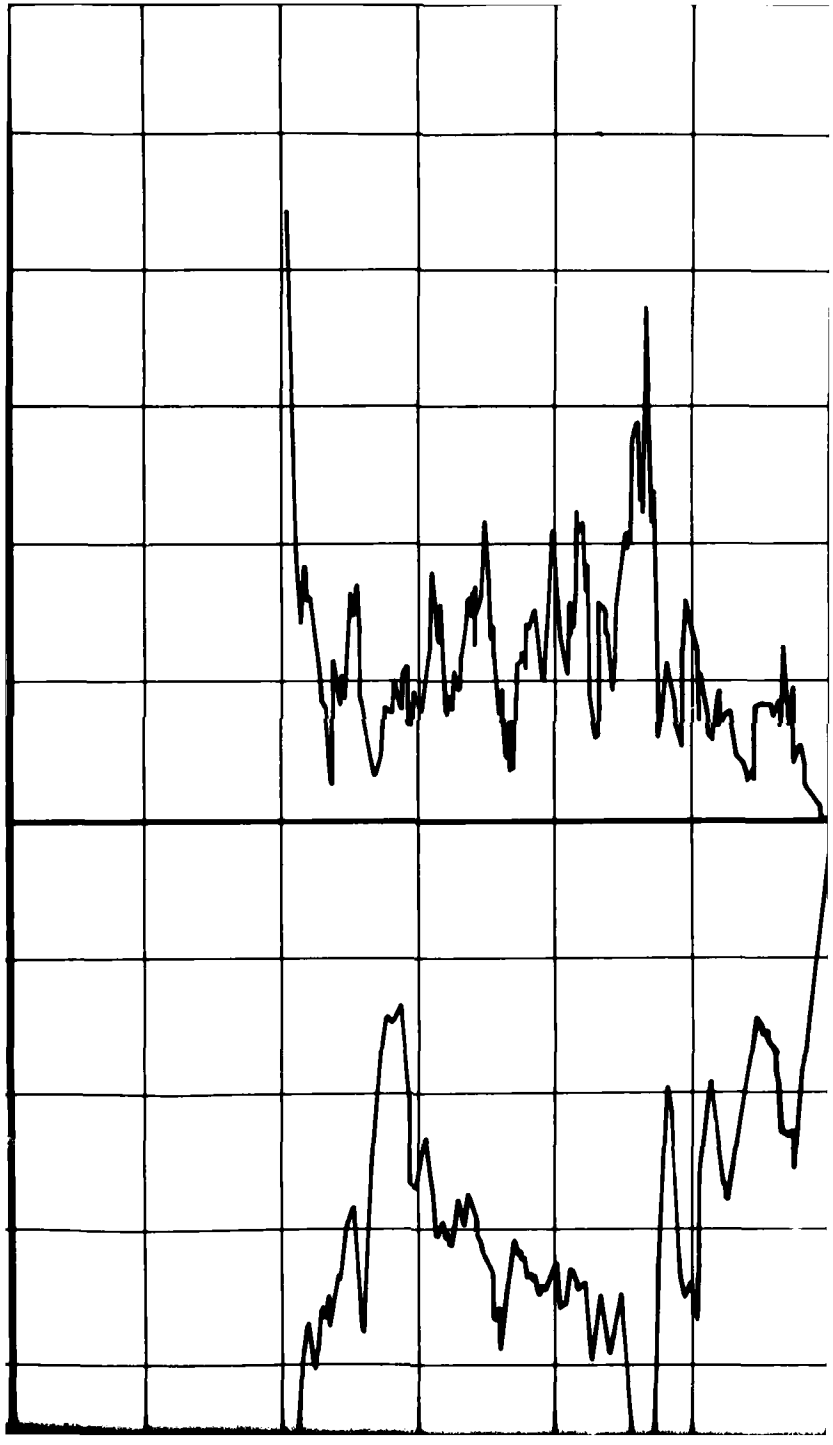

FRICTION RESISTANCE
CONE RESI
DEPTH
(METERS)
(FEET)
12
10
8
6
4
2
0
100
200
300
400
0
1
2
3
4
5
6
7
5
10
15
20

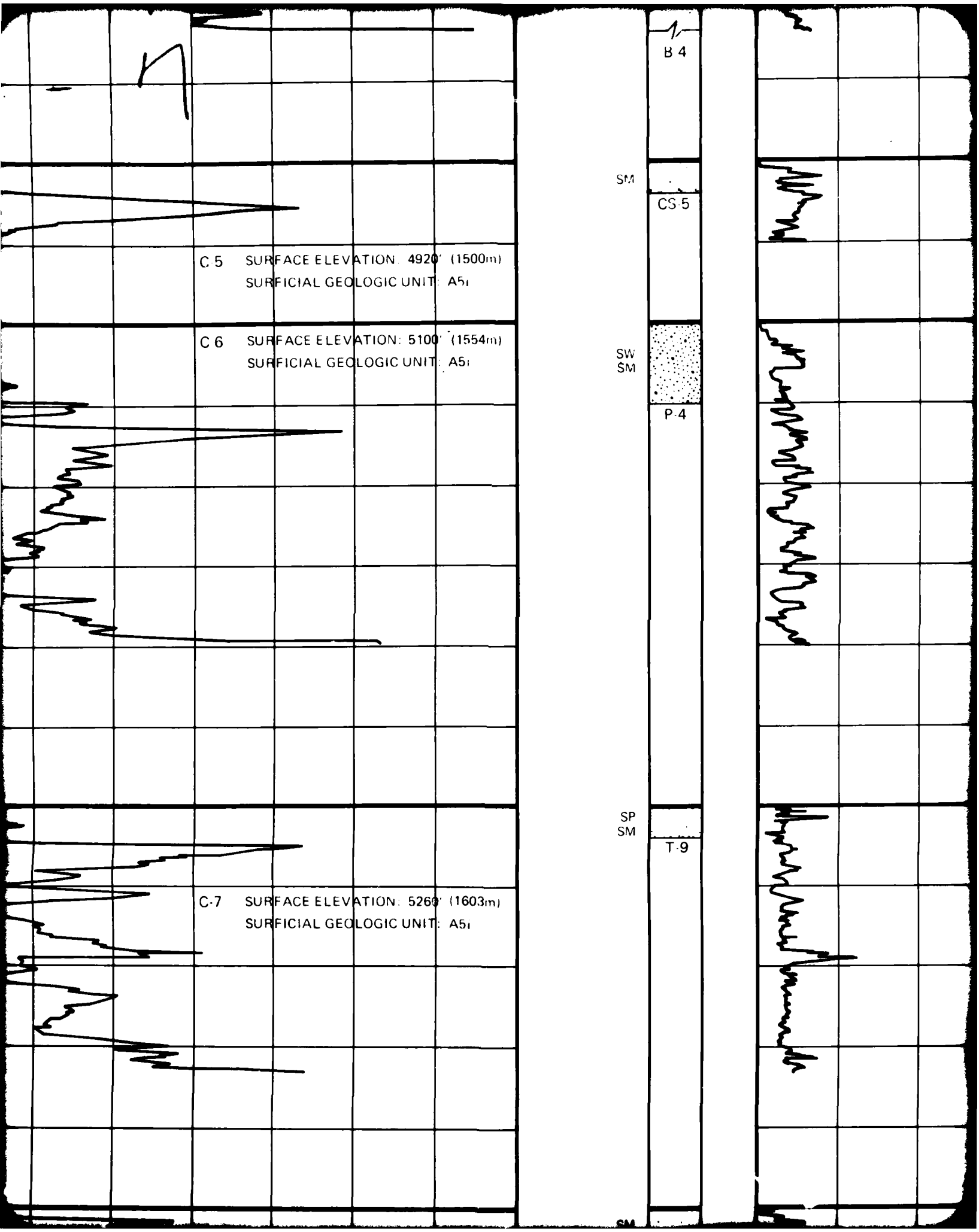

CONE RESISTANCE
FRICTION RATIO
400 500 600 700 800 900 (kg/cm2)
400 500 600 700 800 900 (tsf)
SOIL COLUMN
0 2 4 6
C-1 SURFACE ELEVATION: 4810' (1466m)
SURFICIAL GEOLOGIC UNIT: A5i
C-2 SURFACE ELEVATION: 4980' (1518m)
SURFICIAL GEOLOGIC UNIT: A5i
C-3 SURFACE ELEVATION: 5230' (1594m)
SURFICIAL GEOLOGIC UNIT: A5i
C-4 SURFACE ELEVATION: 4790' (1460m)
SURFICIAL GEOLOGIC UNIT: A5v
SM
CS 1
SM
P 3
SM
SP
T 8
SM
GW
GM
SM
B-4

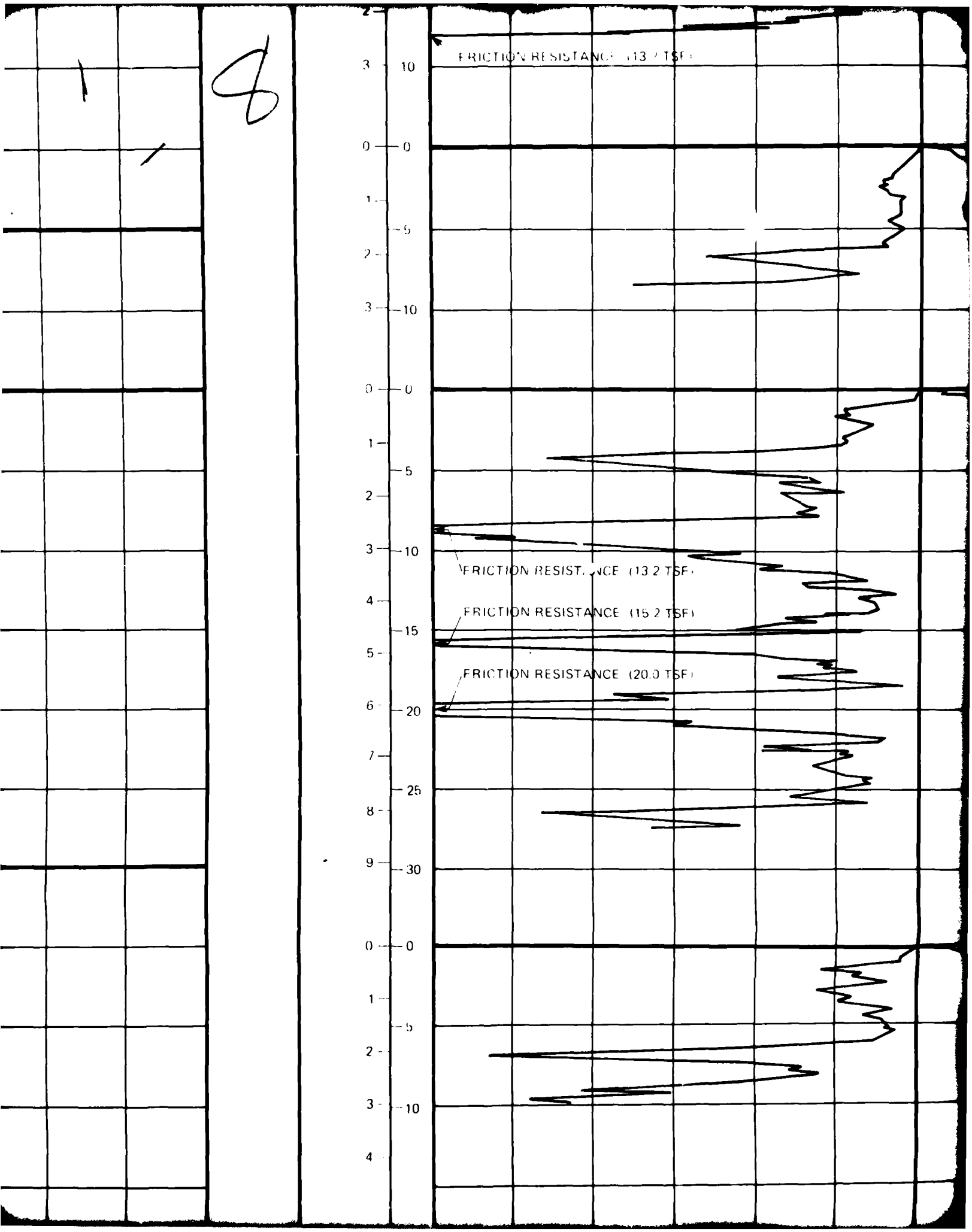

RATIO
6
8 (%)
FRICTION RESISTANCE
DEPTH
(METERS)
(FEET)
12
10
8
6
4
2
0
100
0
1
2
3
4
5
6
7
5
10
15
20
FRICTION RESISTANCE (13.2 TSF)

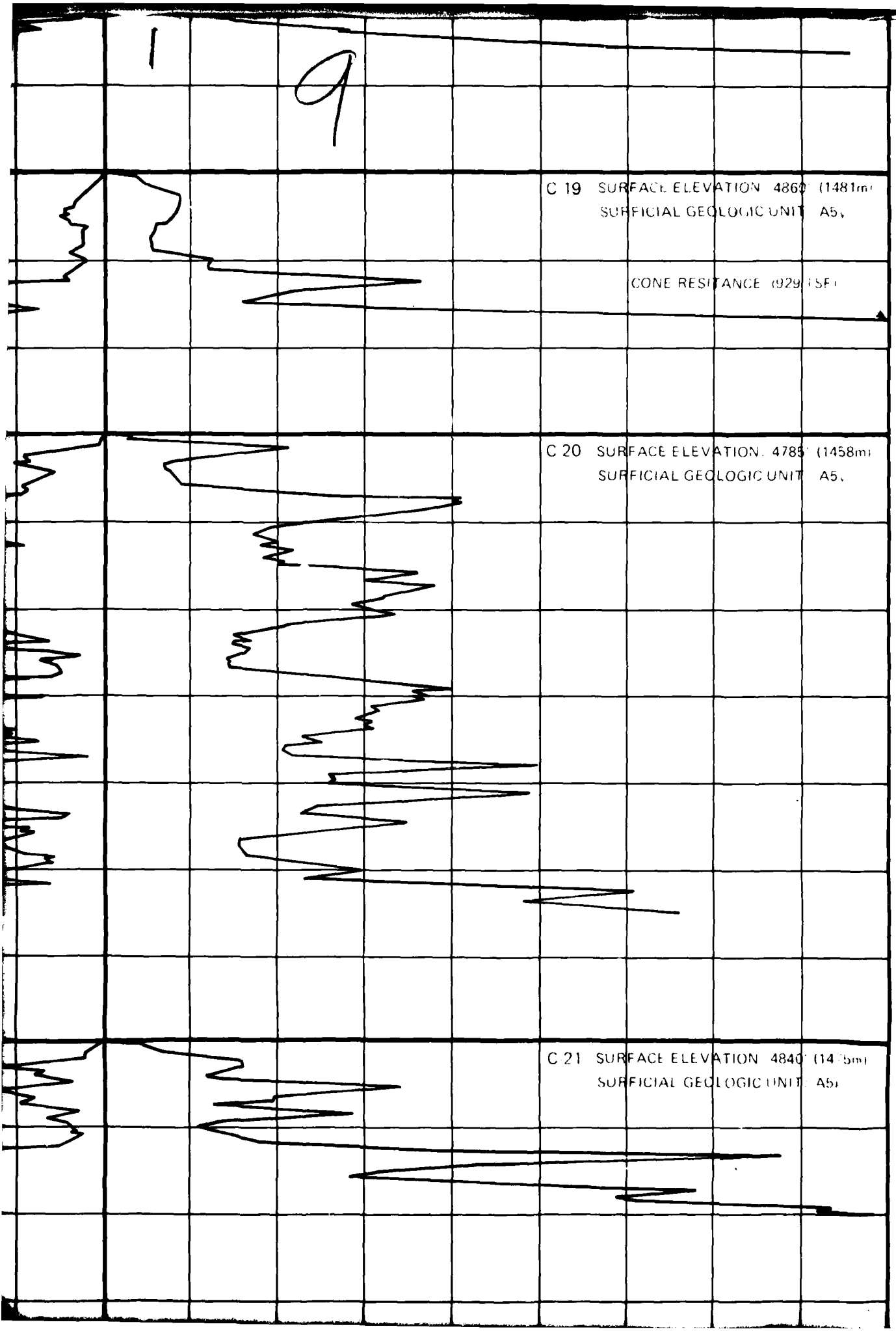

CONE RESISTANCE
100 200 300 400 500 600 700 800 900 (kg/cm²)
100 200 300 400 500 600 700 800 900 (tsf)
SOIL COLUMN
0
SP
SM
P 8
C 16 SURFACE ELEVATION 5520' (1682m)
SURFICIAL GEOLOGIC UNIT: A5r
SM
SP
SP
SM
T 3
C-17 SURFACE ELEVATION: 5280' 1609m)
SURFICIAL GEOLOGIC UNIT: A5r
C-18 SURFACE ELEVATION 4920' (1500m)
SURFICIAL GEOLOGIC UNIT A5y
SM
CS 18

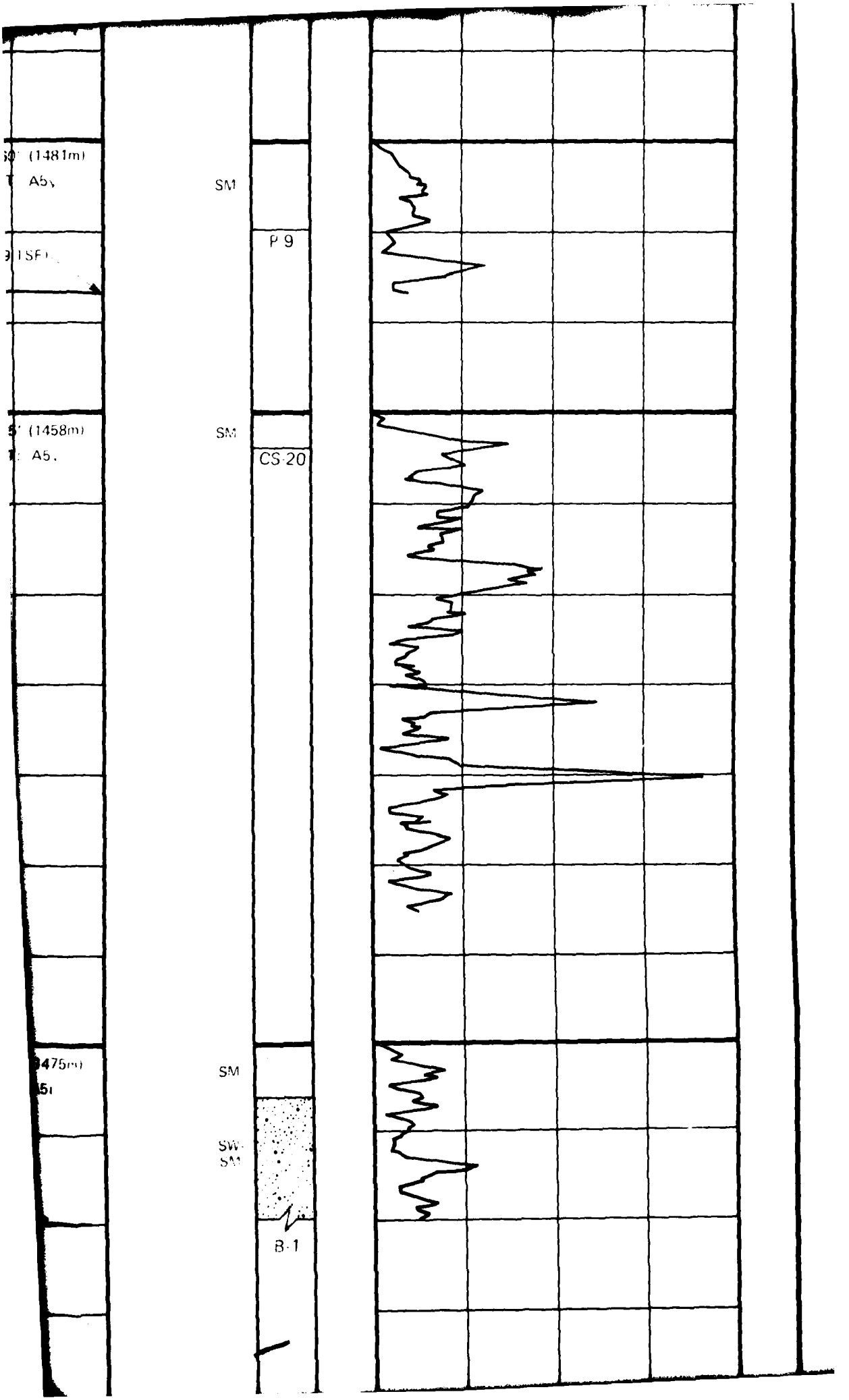

FRICTION RATIO
g/cm²)
sf)
SOIL COLUMN
0
2
4
6
8 (%)
SP
SM
P 8
SM
SP
SP
SM
T 3
SM
CS 18

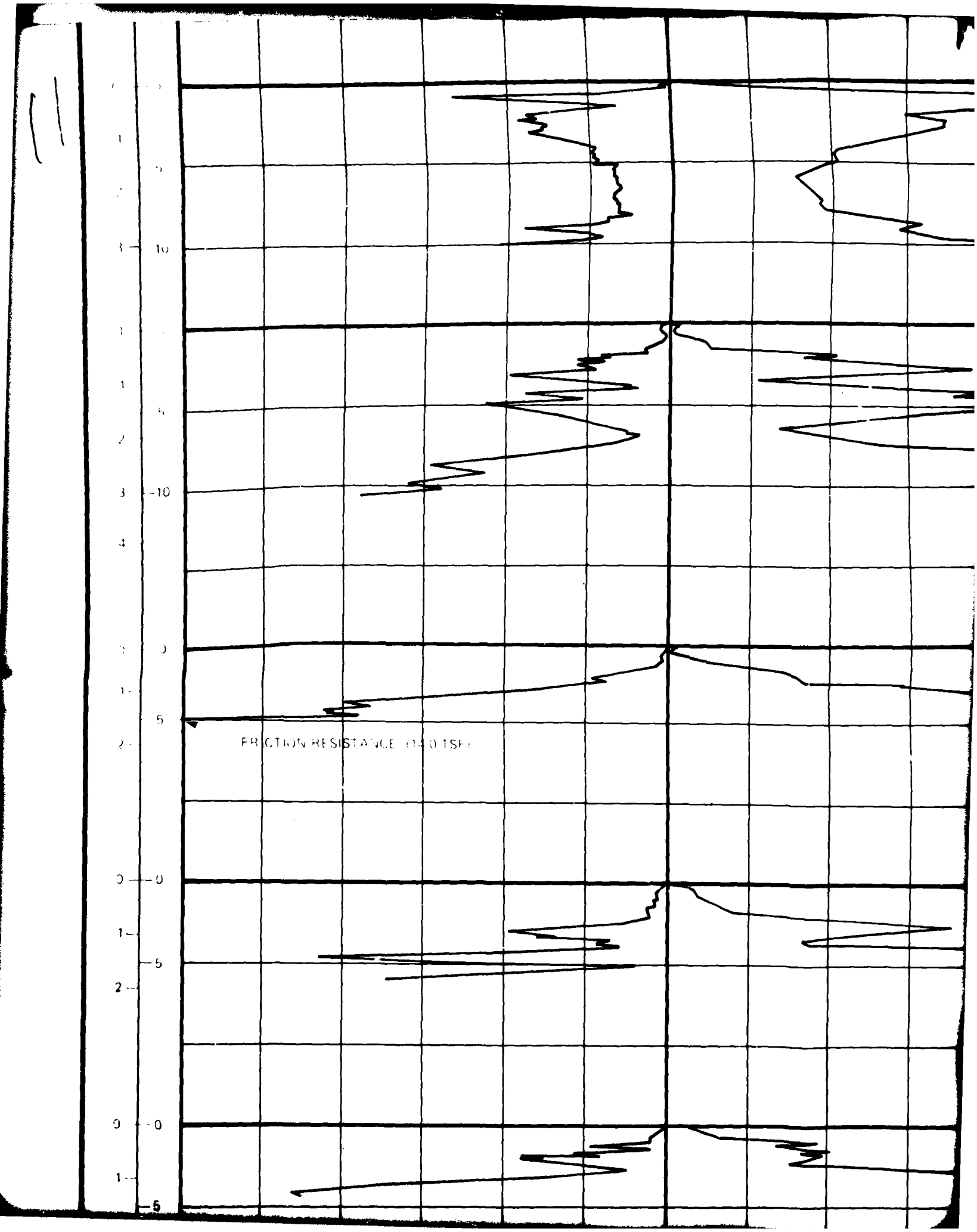


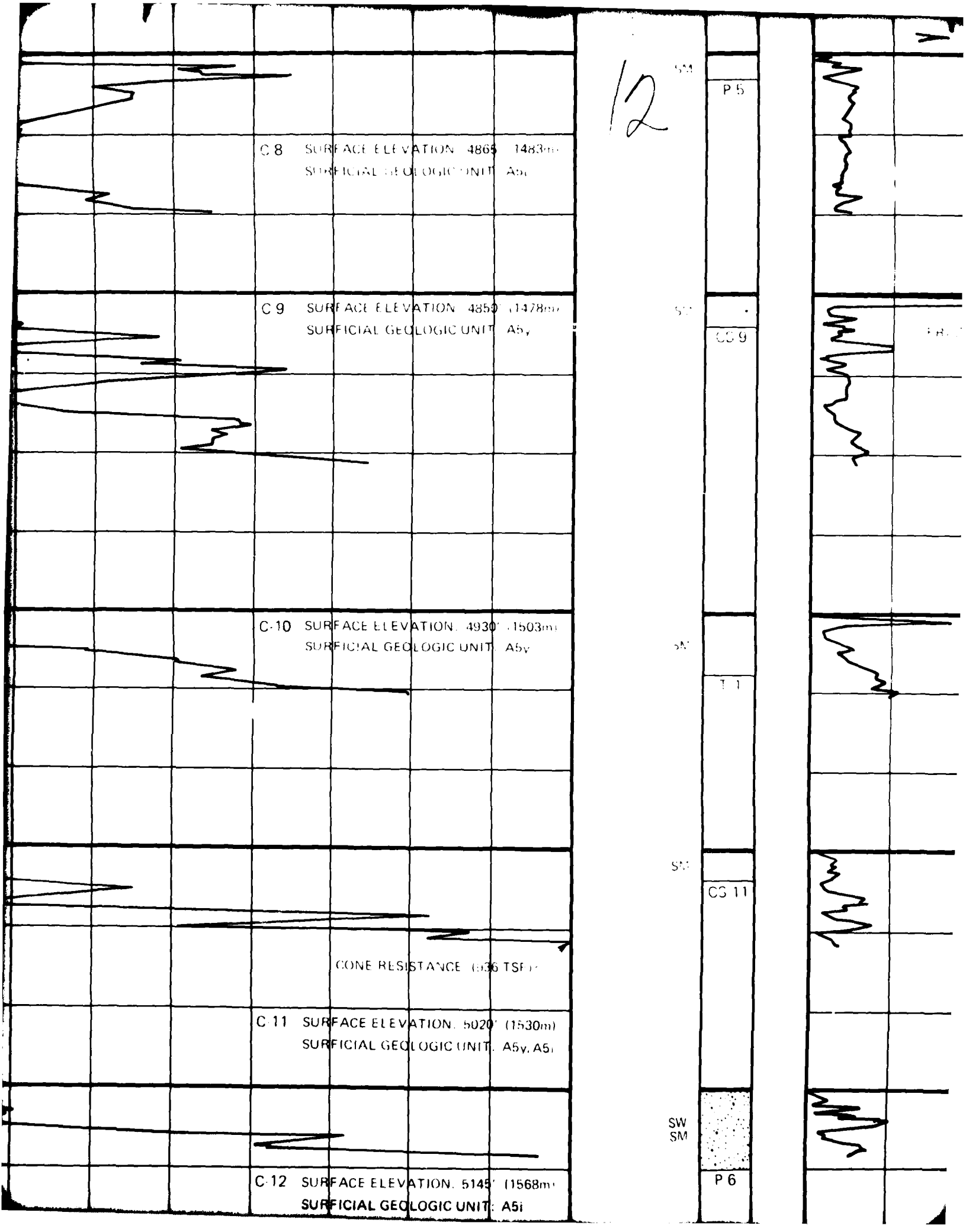

B 4
SM
CS 5
C 5 SURFACE ELEVATION: 4920' (1500m)
SURFICIAL GEOLOGIC UNIT: A5i
C 6 SURFACE ELEVATION: 5100' (1554m)
SURFICIAL GEOLOGIC UNIT: A5i
SW
SM
P 4
SP
SM
T 9
C-7 SURFACE ELEVATION: 5269' (1603m)
SURFICIAL GEOLOGIC UNIT: A5i

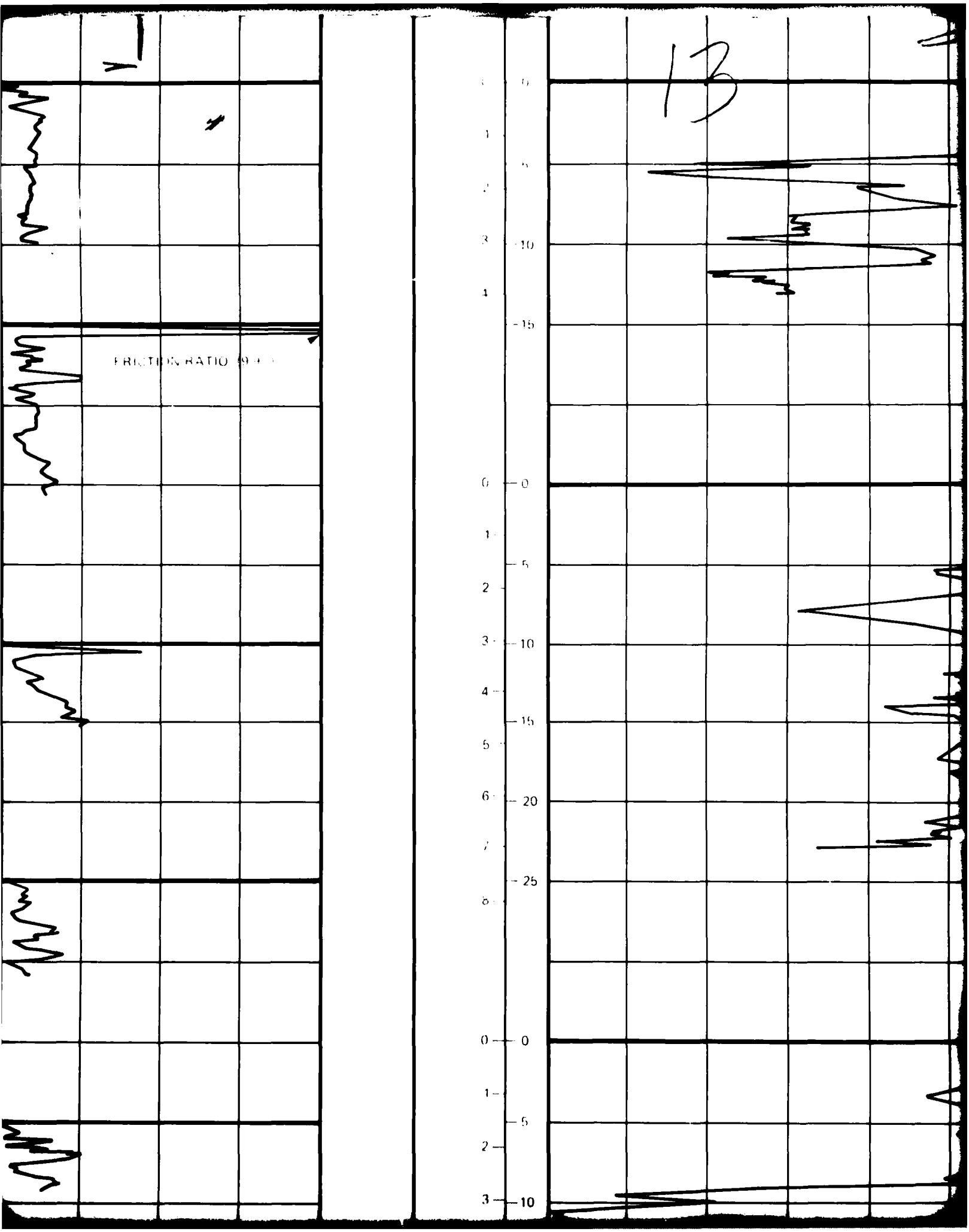

FRICTION RESISTANCE (13.2 TSF)
FRICTION RESISTANCE (13.2 TSF)
FRICTION RESISTANCE (15.2 TSF)
FRICTION RESISTANCE (20.0 TSF)
2
3
0
1
2
3
0
1
2
3
4
5
6
7
8
9
0
1
2
3
4
10
0
5
10
0
5
10
15
20
25
30
0
5
10

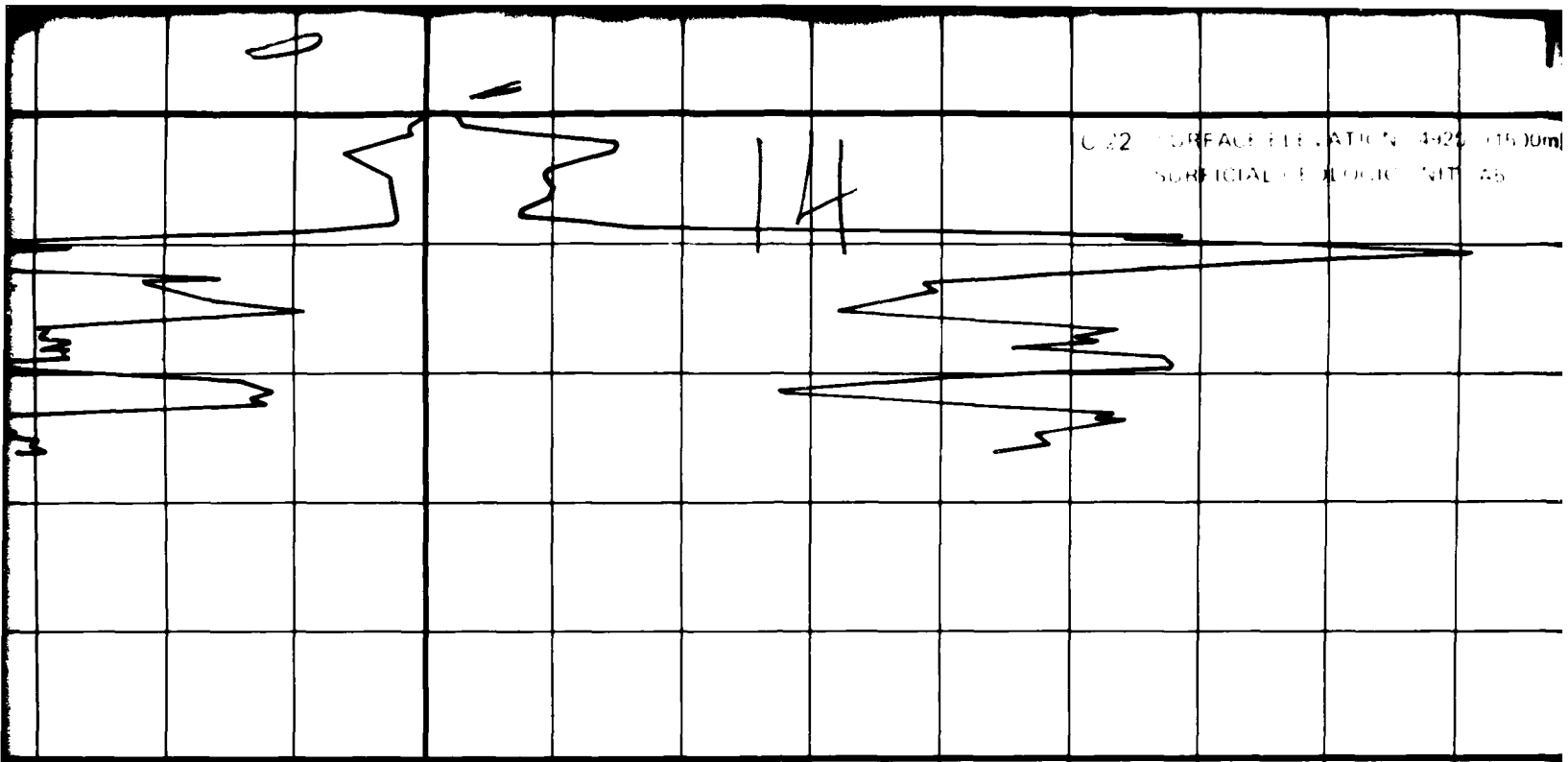

C 19 SURFACE ELEVATION 4860' (1481m)
SURFICIAL GEOLOGIC UNIT A5,
CONE RESISTANCE (929 TSF)
C 20 SURFACE ELEVATION 4785' (1458m)
SURFICIAL GEOLOGIC UNIT A5,
C 21 SURFACE ELEVATION 4840' (14 5m)
SURFICIAL GEOLOGIC UNIT A5,

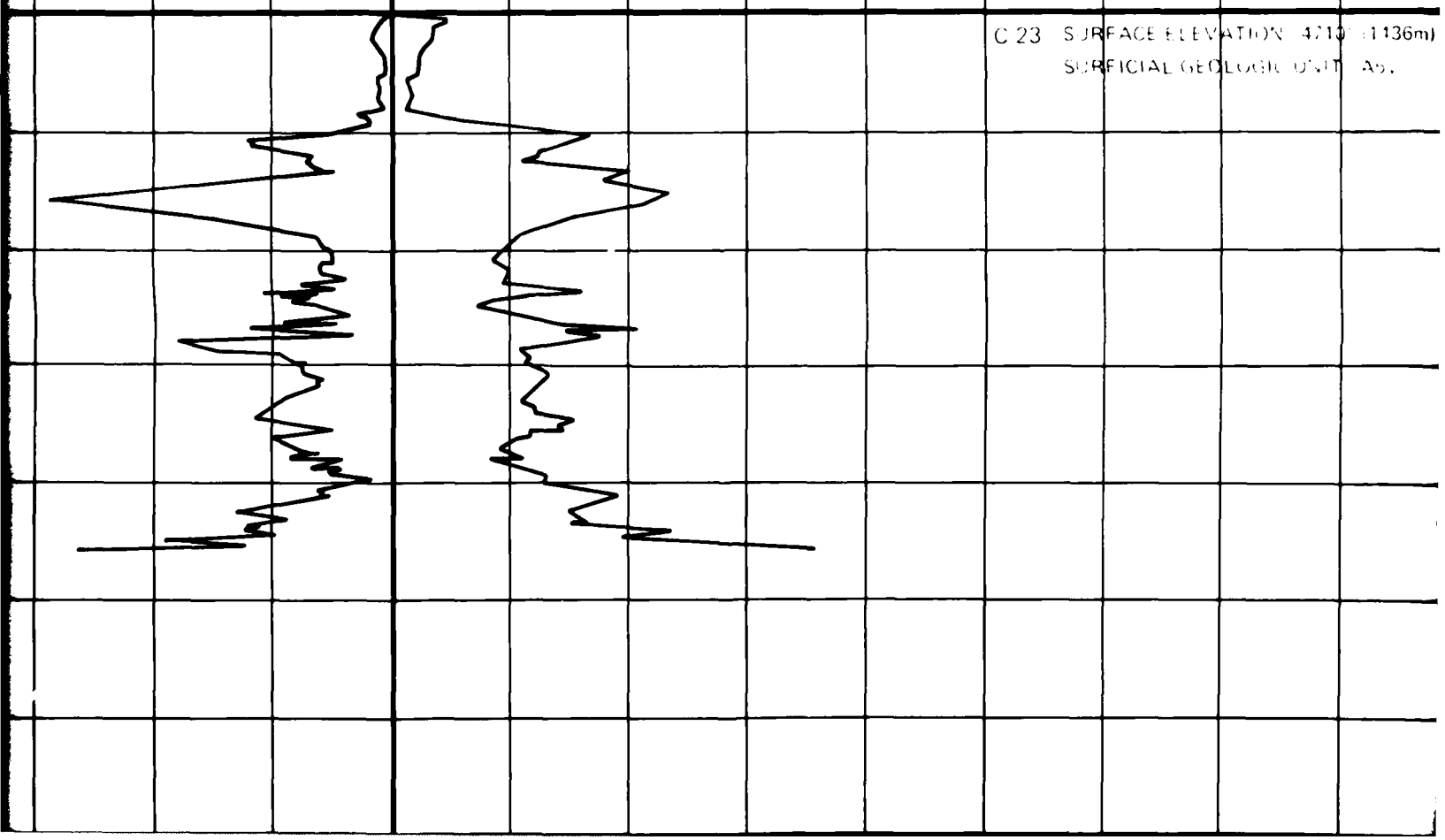

(1481m)
A5
SM
P 9
(1458m)
A5
SM
CS-20
475m)
SM
SW-
SM
B-1

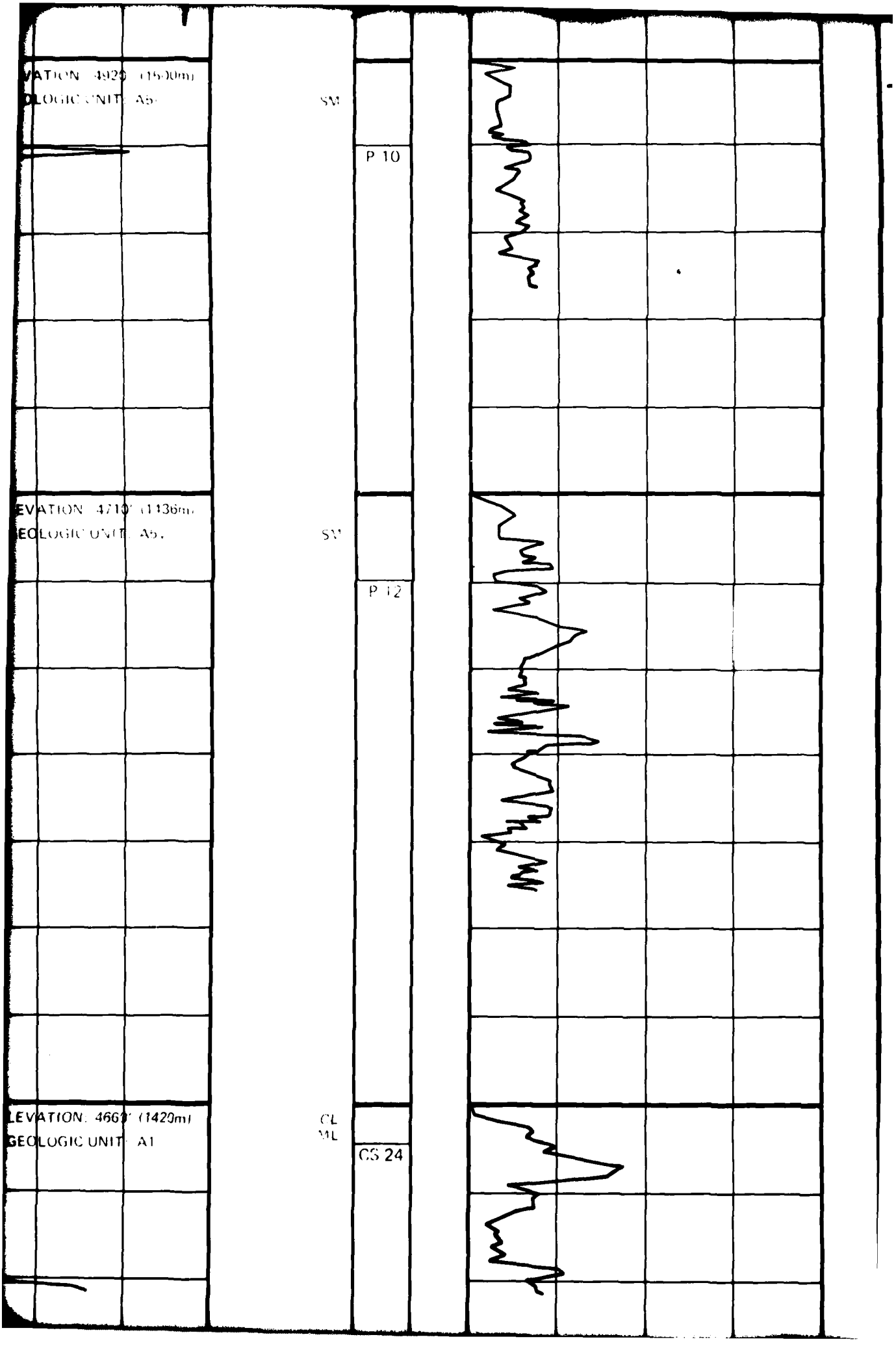

FRICTION RESISTANCE (140 TSF)

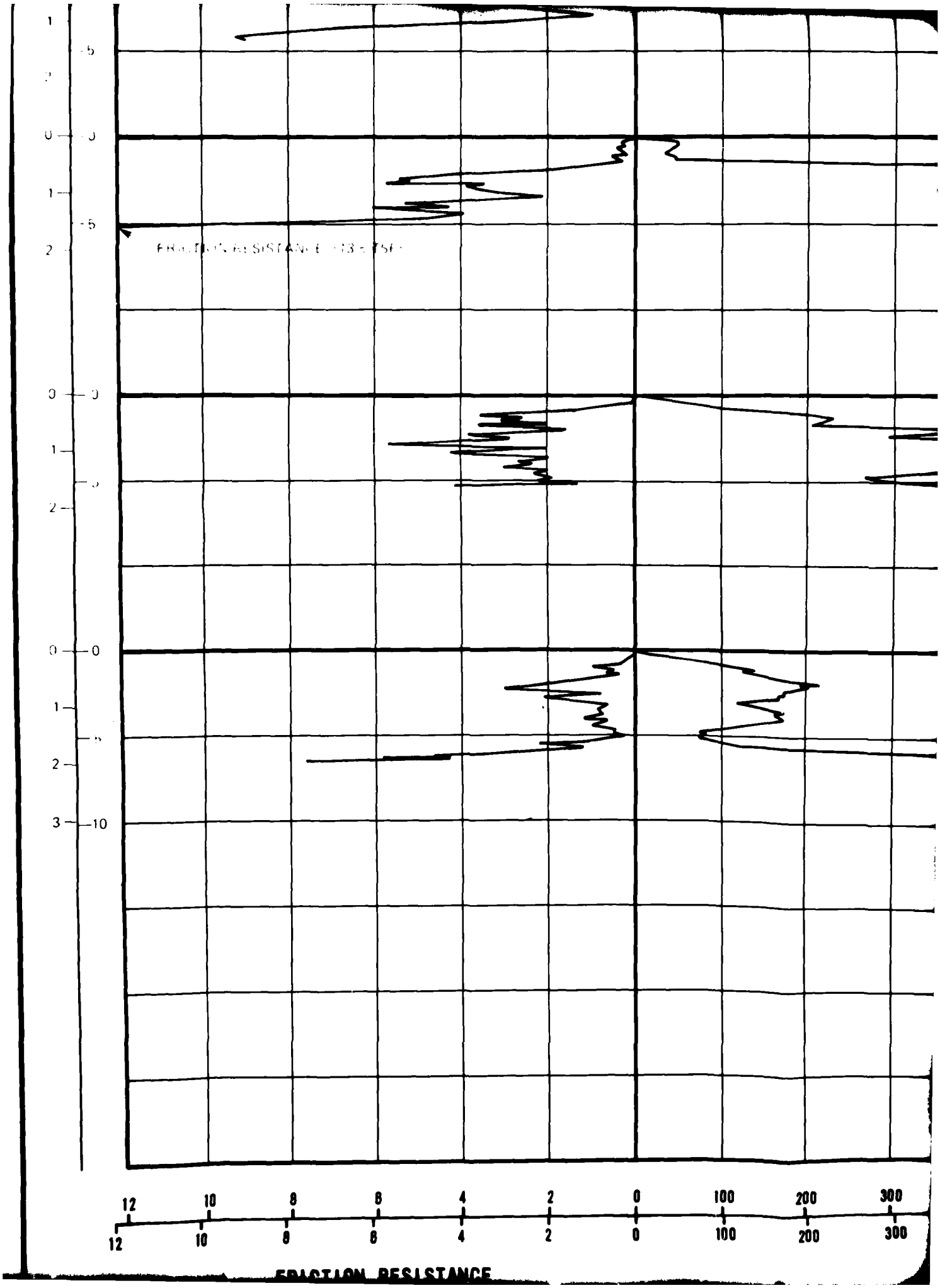

12
SM
P 5
C 8 SURFACE ELEVATION 4865' (1483m)
SURFICIAL GEOLOGIC UNIT: A5i
C 9 SURFACE ELEVATION 4850' (1478m)
SURFICIAL GEOLOGIC UNIT: A5y
CG 9
C-10 SURFACE ELEVATION: 4930' (1503m)
SURFICIAL GEOLOGIC UNIT: A5y
T 1
SM
CG 11
CONE RESISTANCE (636 TSF)
C-11 SURFACE ELEVATION: 5020' (1530m)
SURFICIAL GEOLOGIC UNIT: A5y, A5i
SW
SM
C-12 SURFACE ELEVATION: 5145' (1568m)
SURFICIAL GEOLOGIC UNIT: A5i
P 6

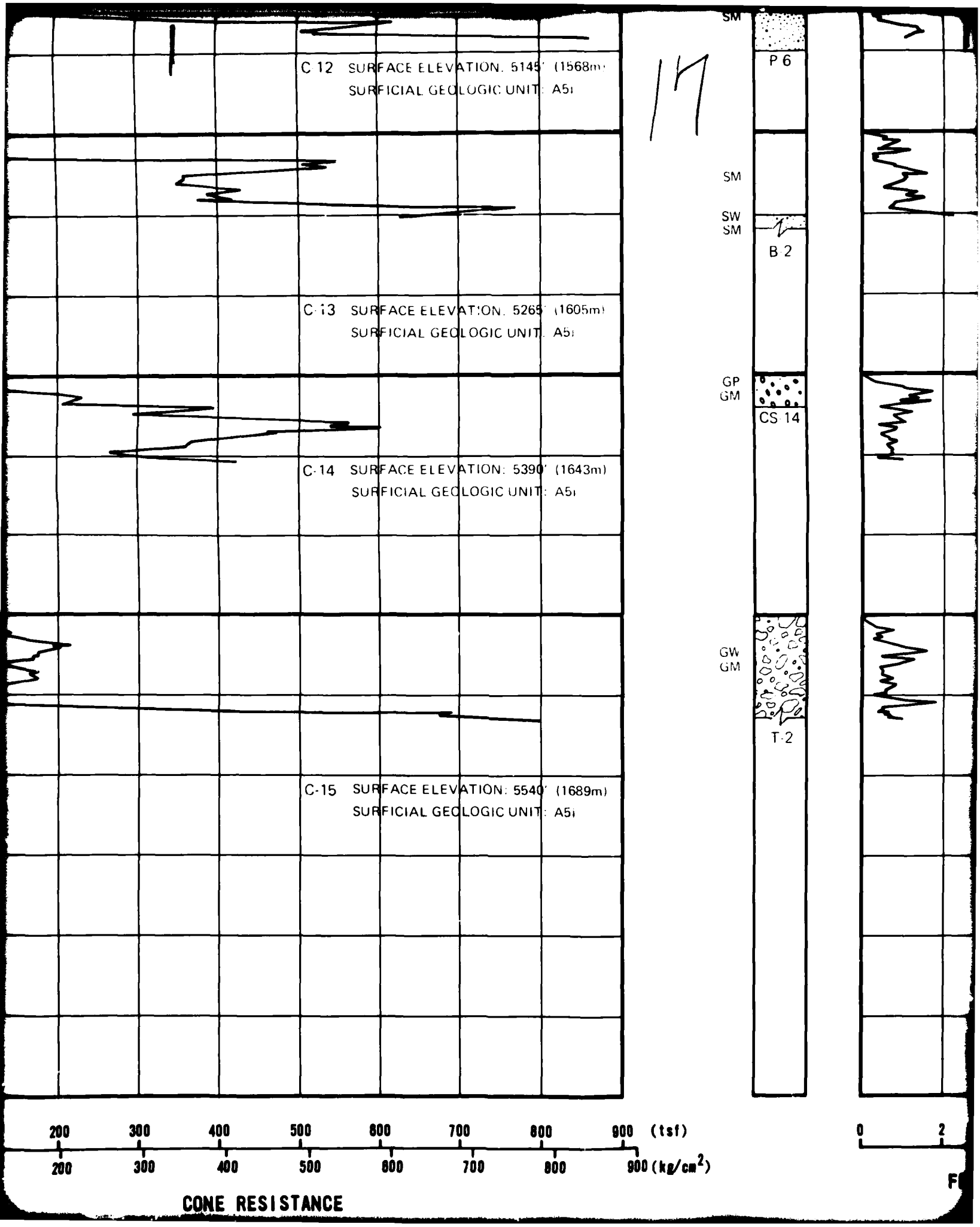

13
FRICTION RATIO
0
1
2
3
4
5
6
7
8
0
1
2
3
0
1
2
3
0
5
10
15
0
5
10
15
20
25
0
5
10

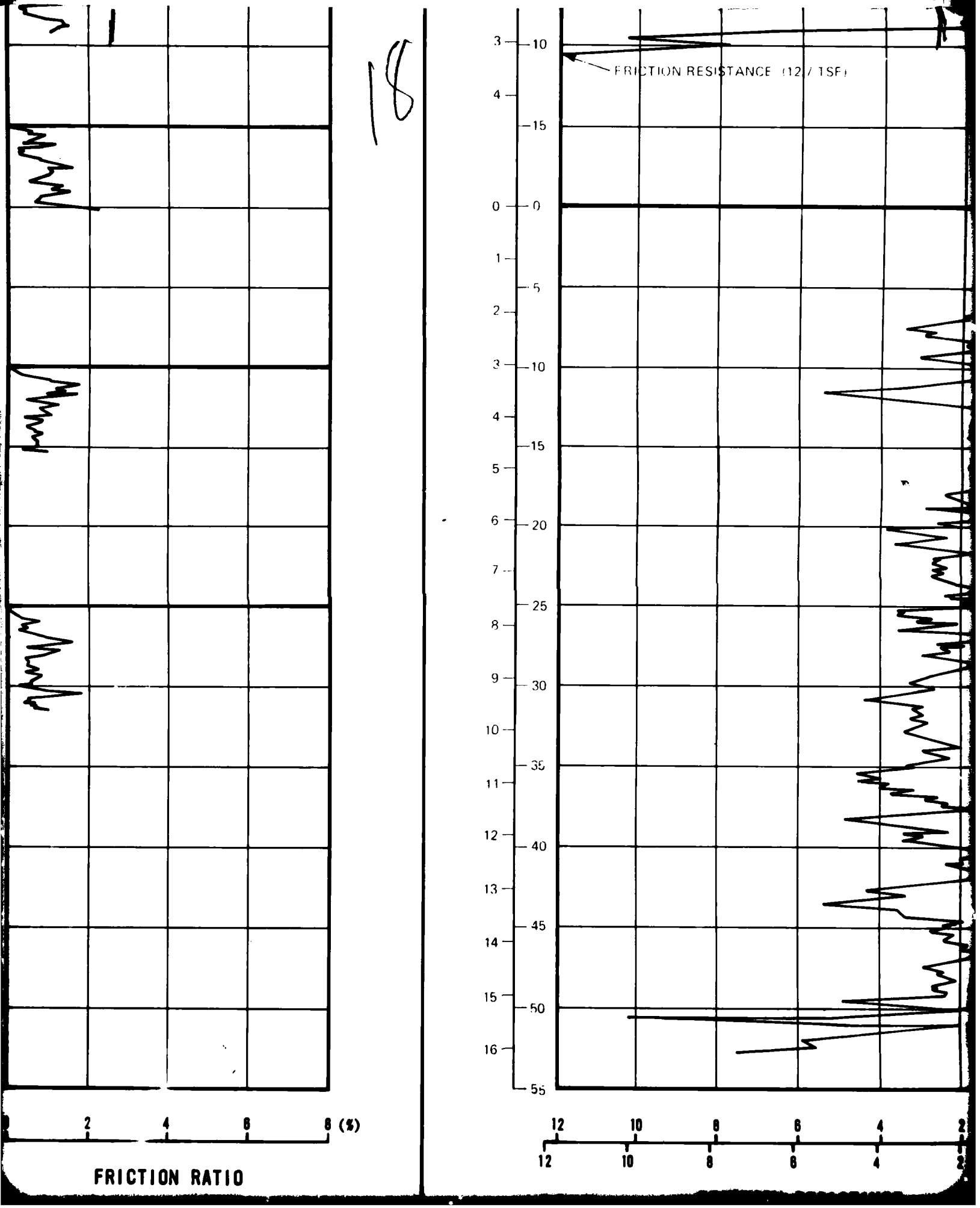

C 22 SURFACE ELEVATION 4525 (1500m)
SURFICIAL GEOLOGIC UNIT A5
114

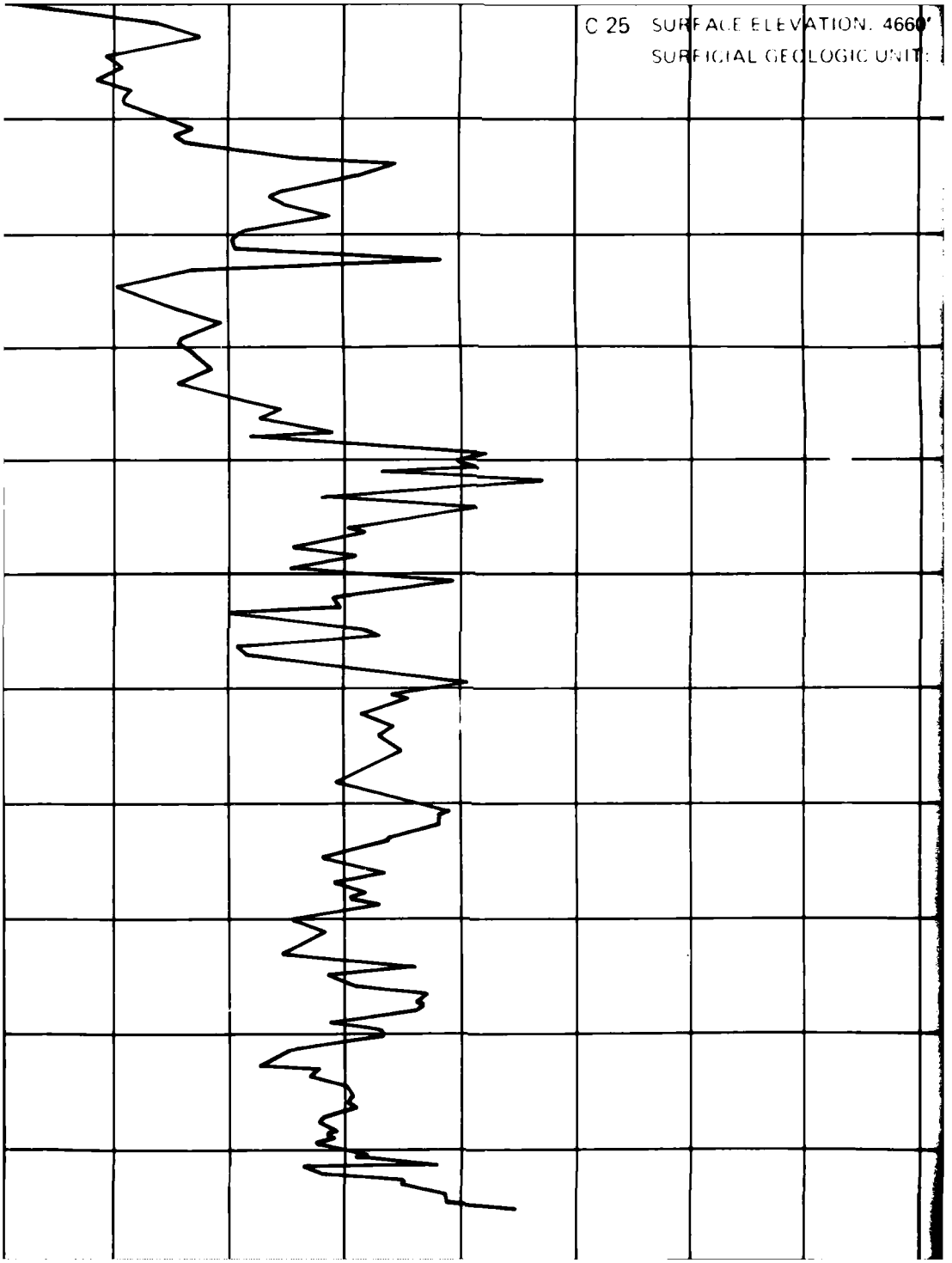

C 23 SURFACE ELEVATION 4710 (1436m)
SURFICIAL GEOLOGIC UNIT A5.

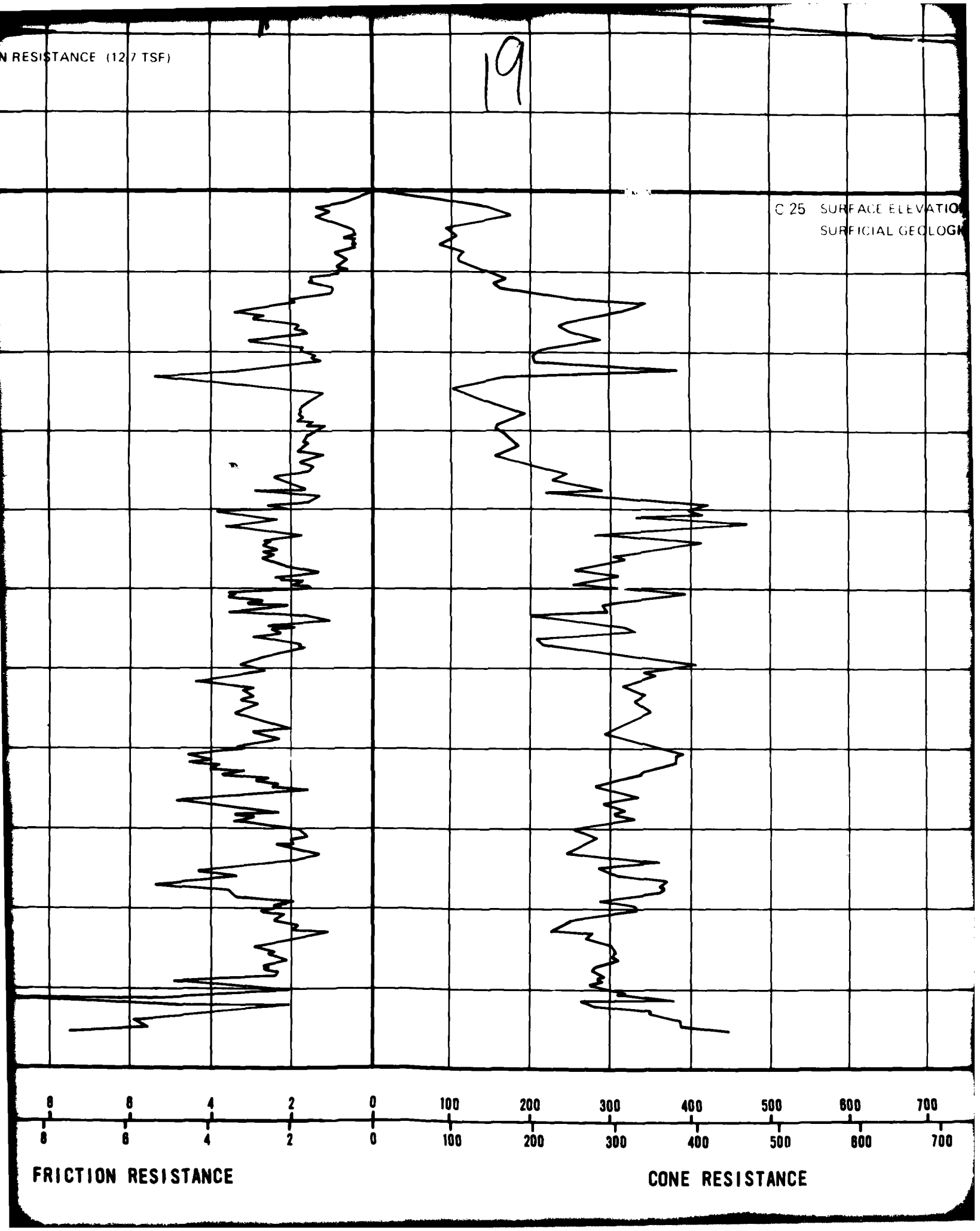

VATION 4920' (1500m)
OLOGIC UNIT A5
SM
P 10
EVATION 4710' (1436m)
EOLOGIC UNIT A5
SM
P 12
LEVATION 4660' (1420m)
GEOLOGIC UNIT A1
CL
ML
CS 24

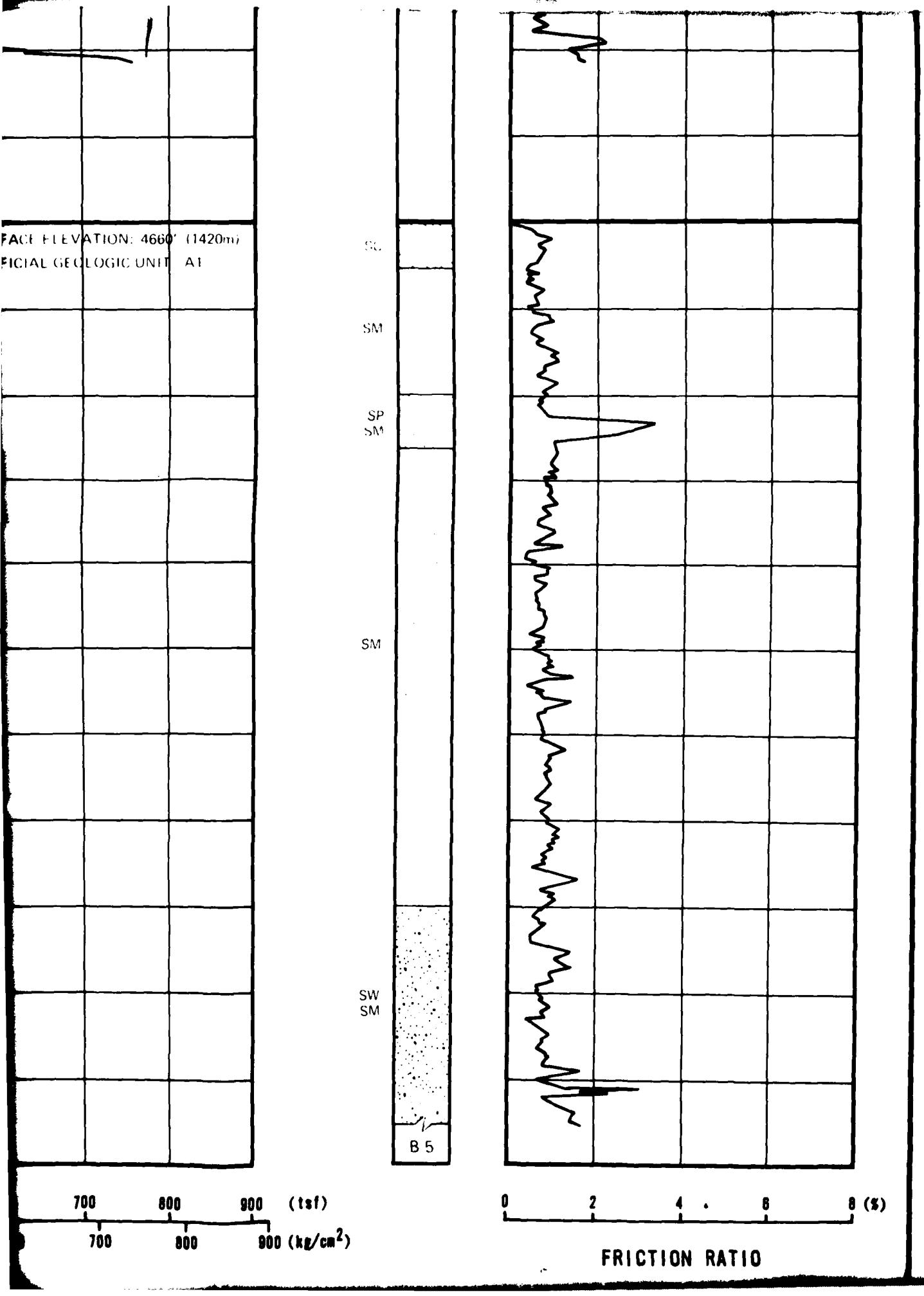

FRICTION RESISTANCE
12
10
8
6
4
2
0
100
200
300

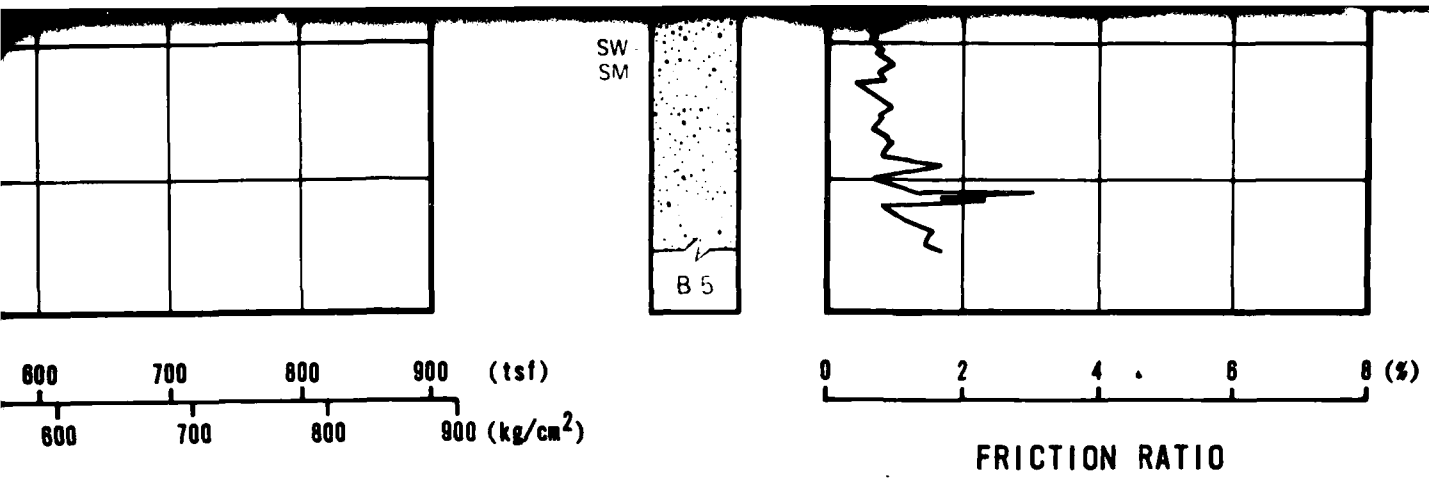

C-12 SURFACE ELEVATION: 5145' (1568m)
SURFICIAL GEOLOGIC UNIT: A5i
C-13 SURFACE ELEVATION: 5265' (1605m)
SURFICIAL GEOLOGIC UNIT: A5i
C-14 SURFACE ELEVATION: 5390' (1643m)
SURFICIAL GEOLOGIC UNIT: A5i
C-15 SURFACE ELEVATION: 5540' (1689m)
SURFICIAL GEOLOGIC UNIT: A5i
17
SM
P 6
SM
SW
SM
B 2
GP
GM
CS 14
GW
GM
T 2
200 300 400 500 600 700 800 900 (tsf)
200 300 400 500 600 700 800 900 (kg/cm2)
0 2
CONE RESISTANCE


18
FRICTION RESISTANCE (12 / TSF)
3
4
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
10
15
0
5
10
15
20
25
30
35
40
45
50
55
2
4
6
8 (%)
FRICTION RATIO
12
10
8
6
4
2
12
10
8
6
4
2


C 25 SURFACE ELEVATION. 4660'
SURFICIAL GEOLOGIC UNIT:


N RESISTANCE (12/7 TSF)
19
C 25 SURFACE ELEVATIO
SURFICIAL GEOLOGI
8 6 4 2 0 100 200 300 400 500 600 700
8 6 4 2 0 100 200 300 400 500 600 700
FRICTION RESISTANCE
CONE RESISTANCE


FACE ELEVATION: 4660' (1420m)
FICIAL GEOLOGIC UNIT A1
SC
SM
SP
SM
SM
SW
SM
B 5
700
800
900 (tsf)
700
800
900 (kg/cm2)
0
2
4
6
8 (%)
FRICTION RATIO



CONE PENETROMETER TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

DRAWING
II-9-1
1 OF 2

FUGRO NATIONAL, INC.

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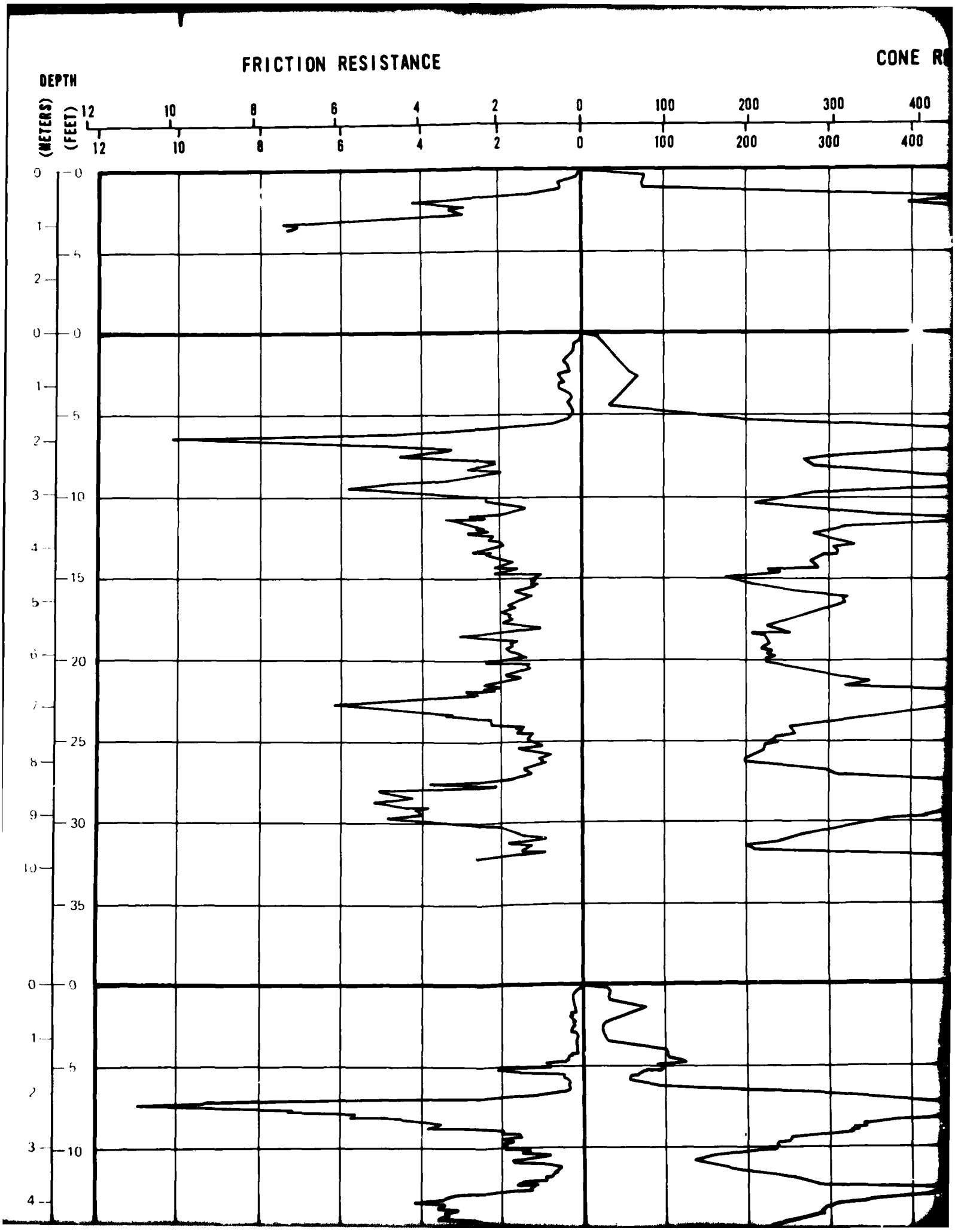
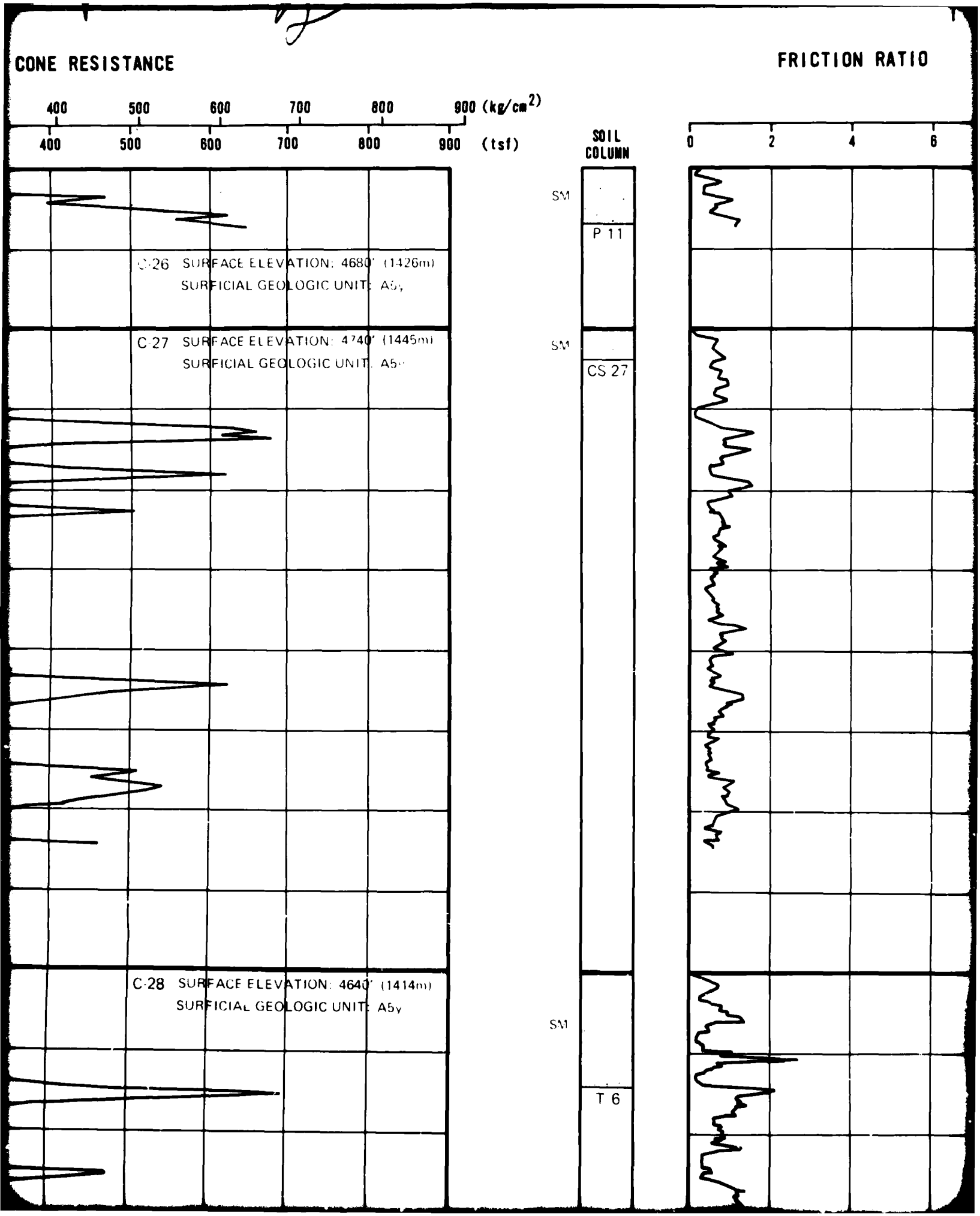
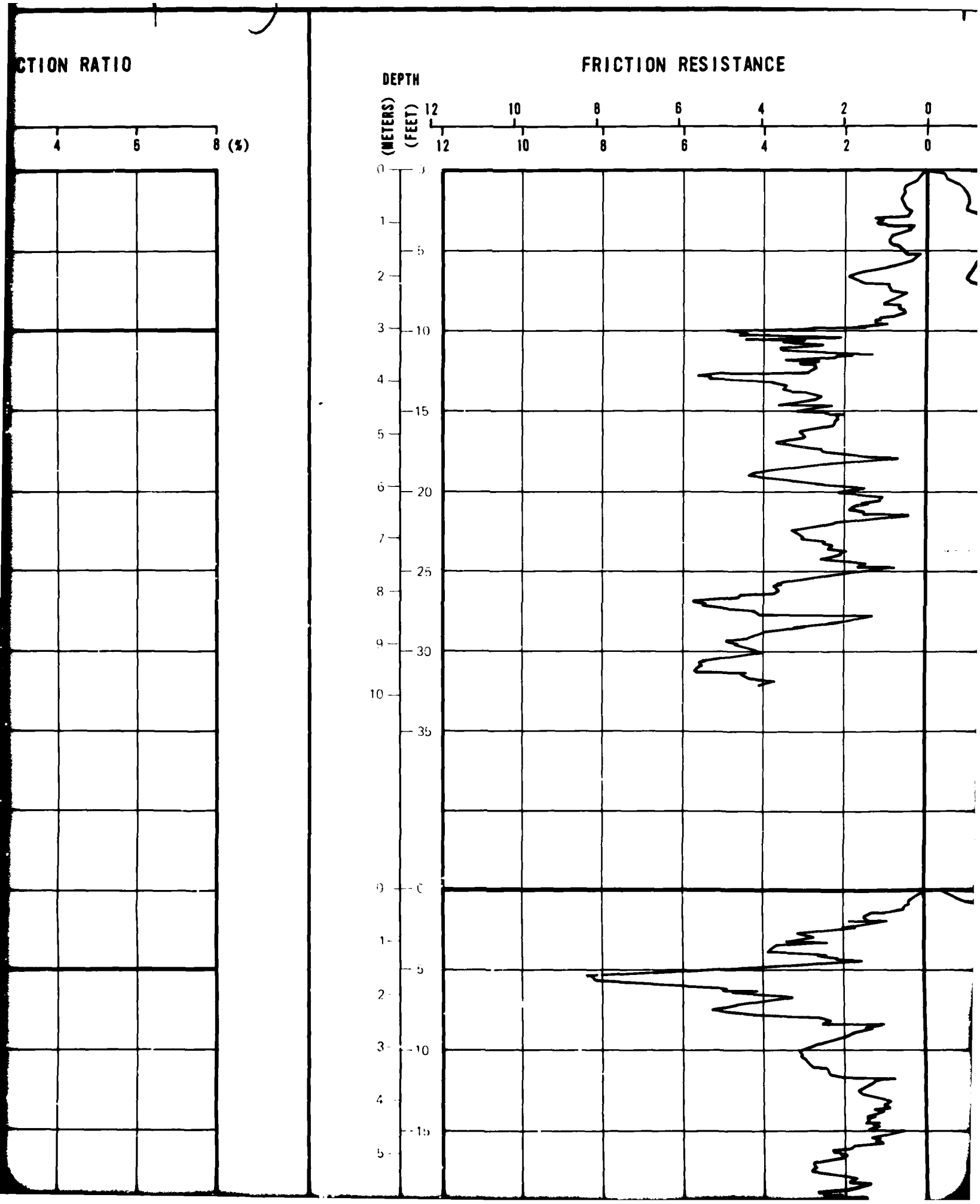
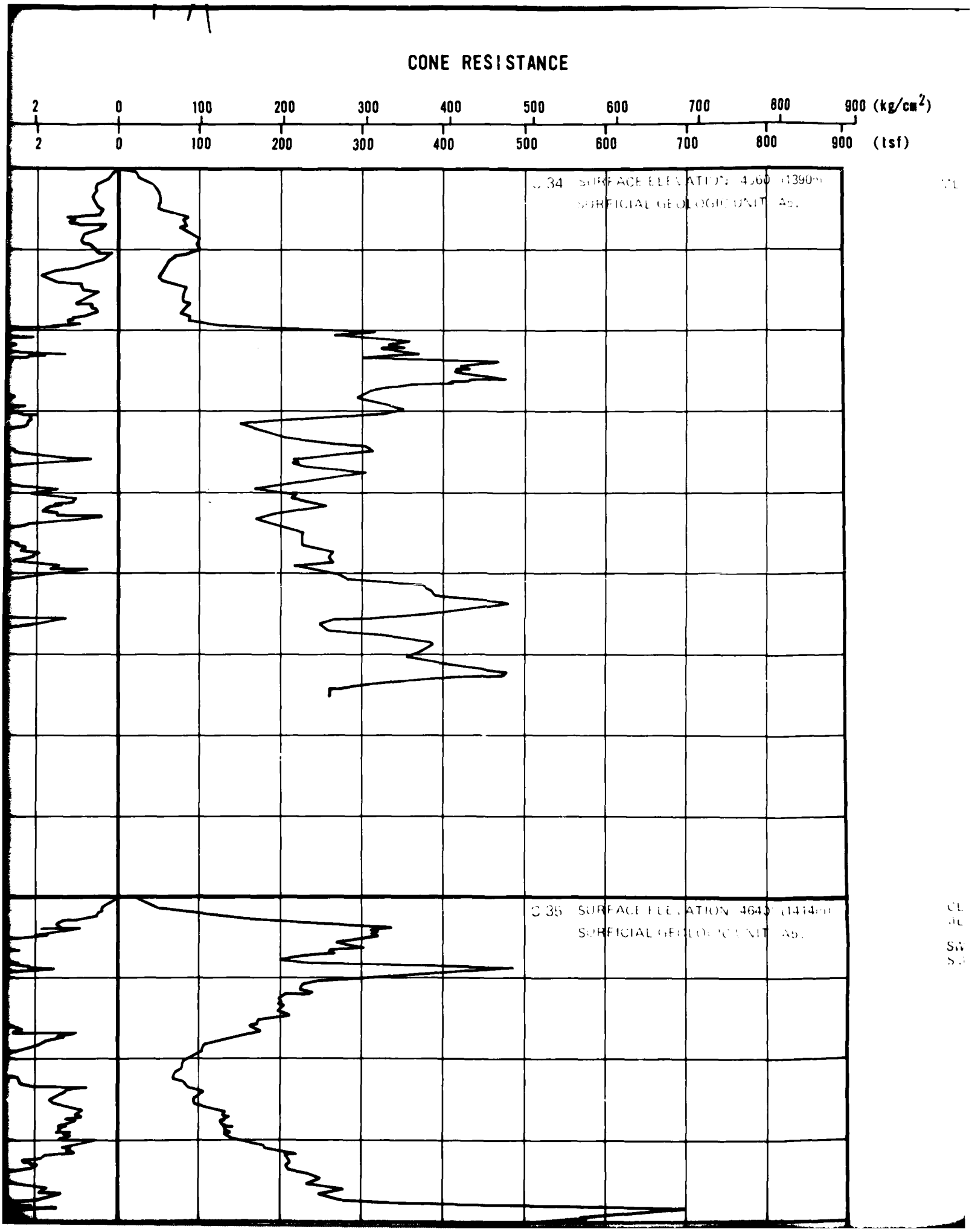
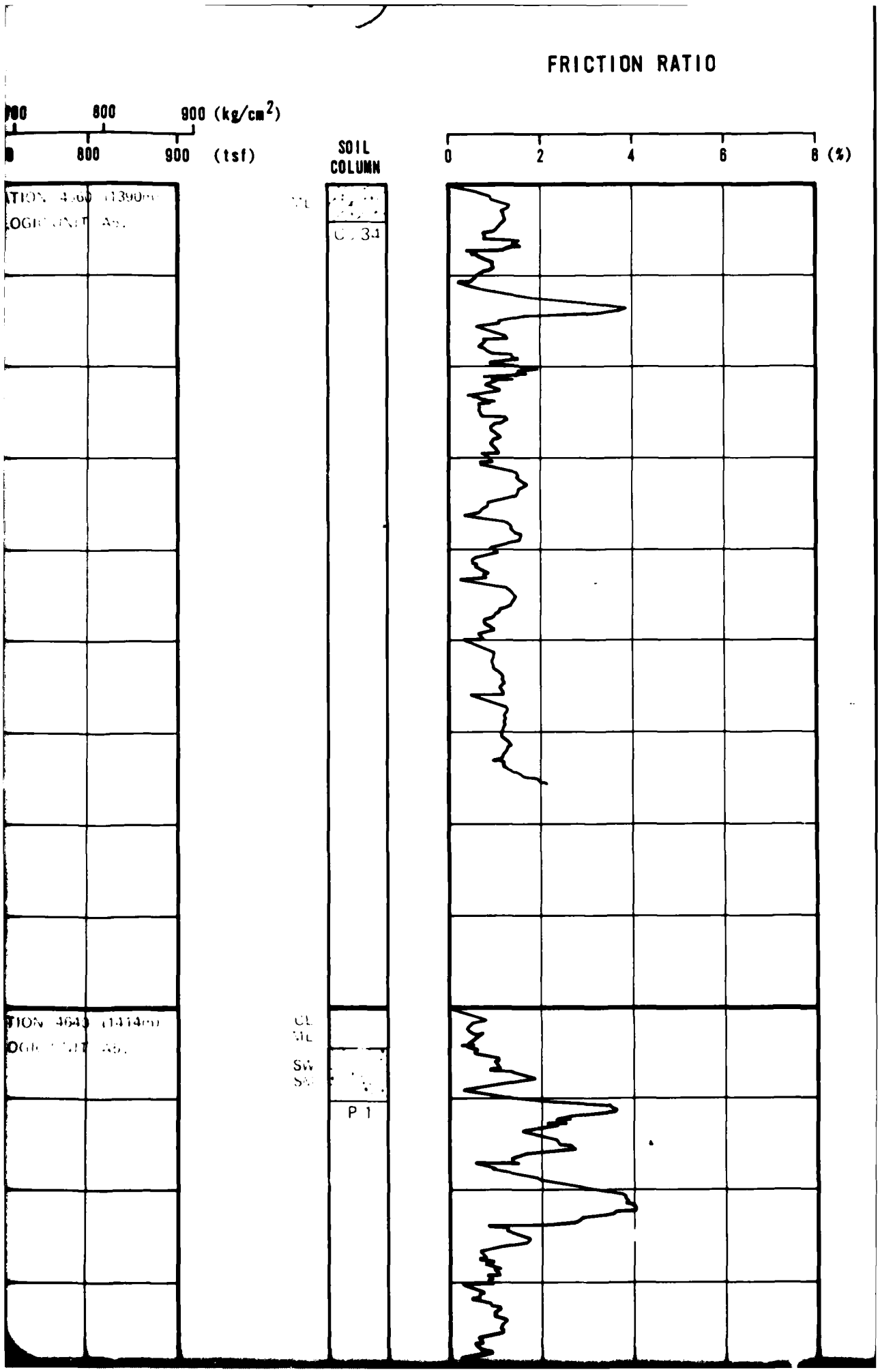
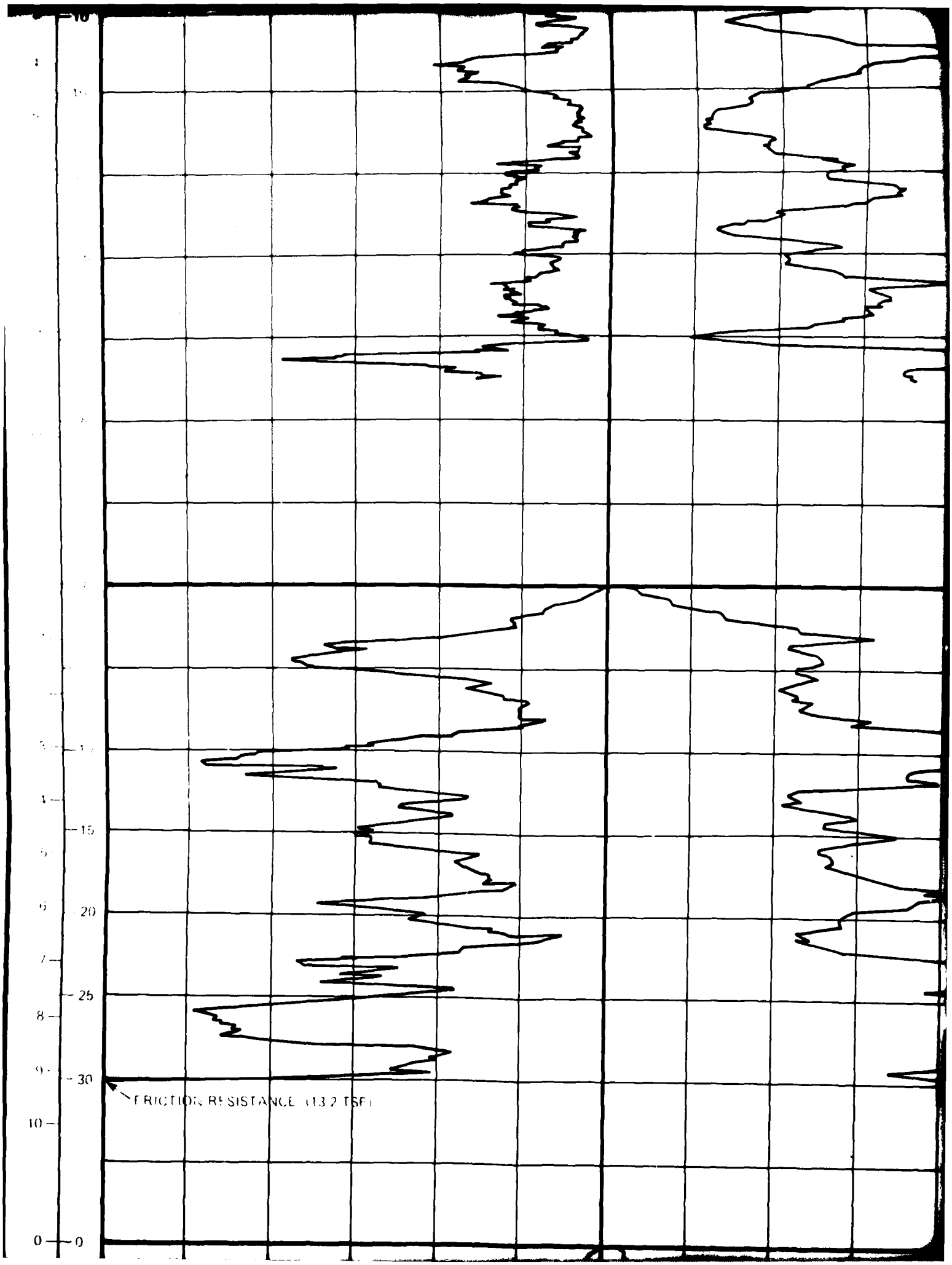

FRICTION RESISTANCE
CONE R
DEPTH
(METERS)
(FEET)
12
10
8
6
4
2
0
100
200
300
400
0
1
2
3
4
5
6
7
8
9
10
5
10
15
20
25
30
35

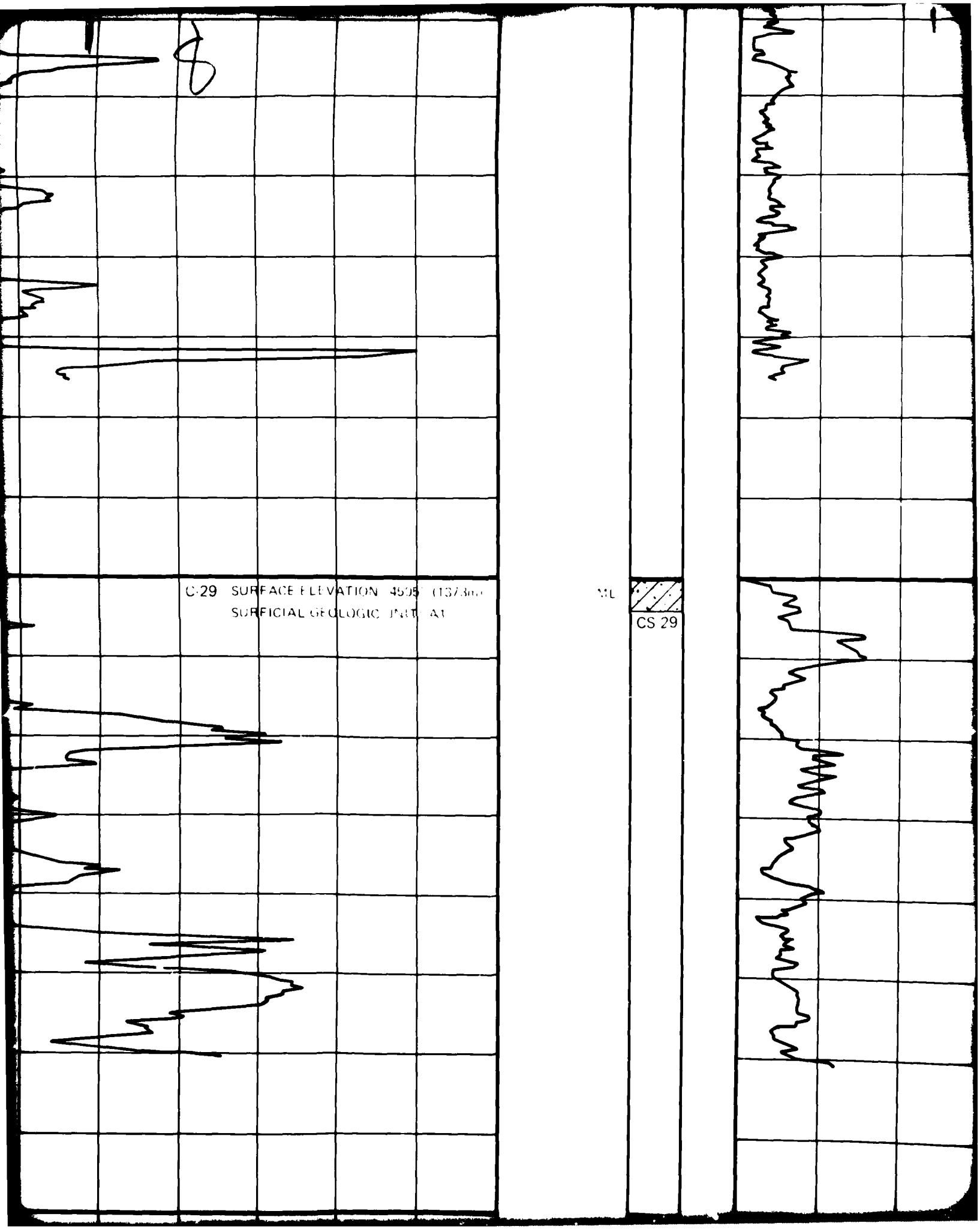

CONE RESISTANCE
400 500 600 700 800 900 (kg/cm2)
400 500 600 700 800 900 (tsf)
SOIL COLUMN
FRICTION RATIO
0 2 4 6
SM
P 11
C-26 SURFACE ELEVATION: 4680' (1426m)
SURFICIAL GEOLOGIC UNIT: A5y
SM
CS 27
C-27 SURFACE ELEVATION: 4740' (1445m)
SURFICIAL GEOLOGIC UNIT: A5y
C-28 SURFACE ELEVATION: 4640' (1414m)
SURFICIAL GEOLOGIC UNIT: A5y
SM
T 6

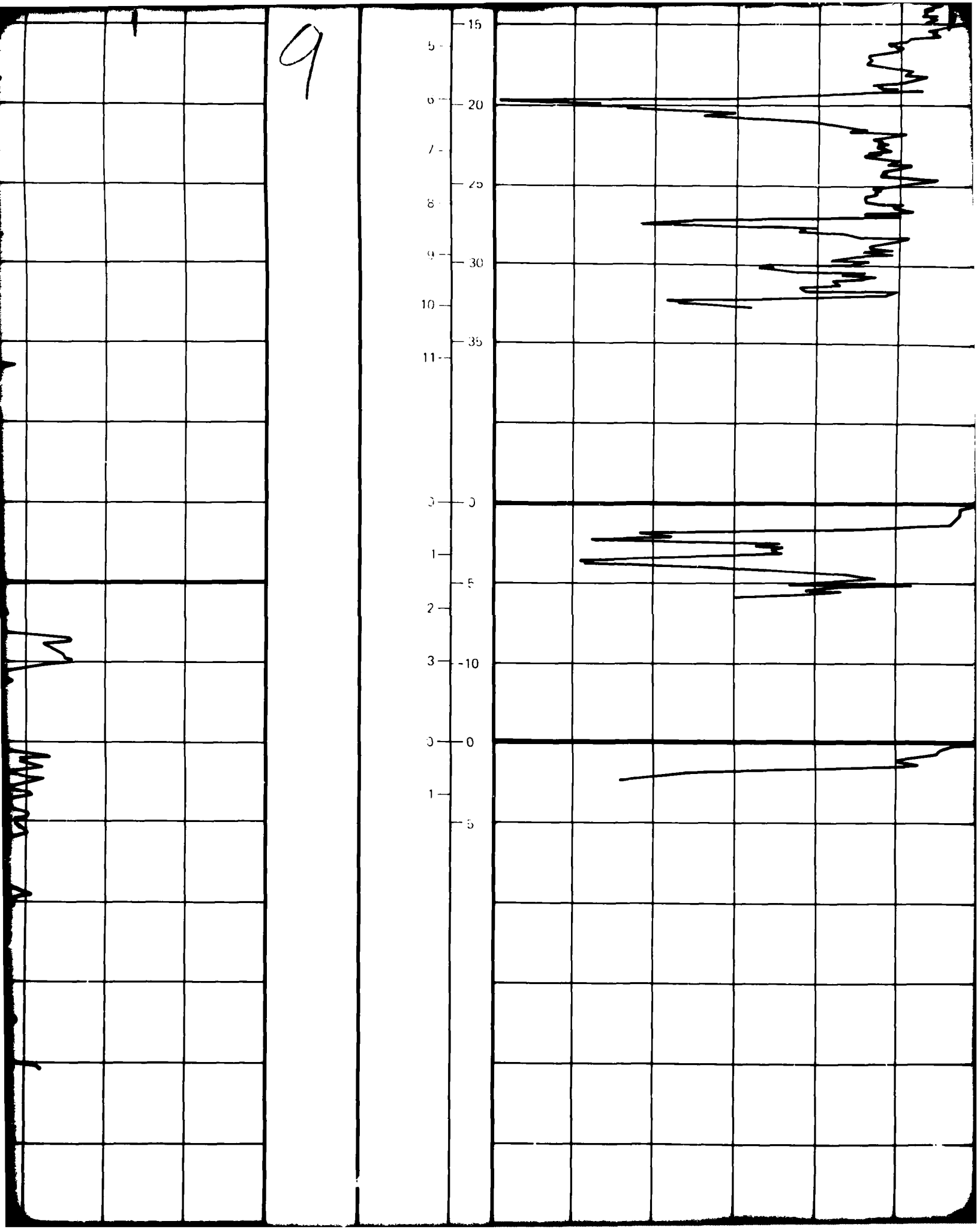

CTION RATIO
4
6
8 (%)
FRICTION RESISTANCE
DEPTH
(METERS)
(FEET)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
5
10
15
20
25
30
35

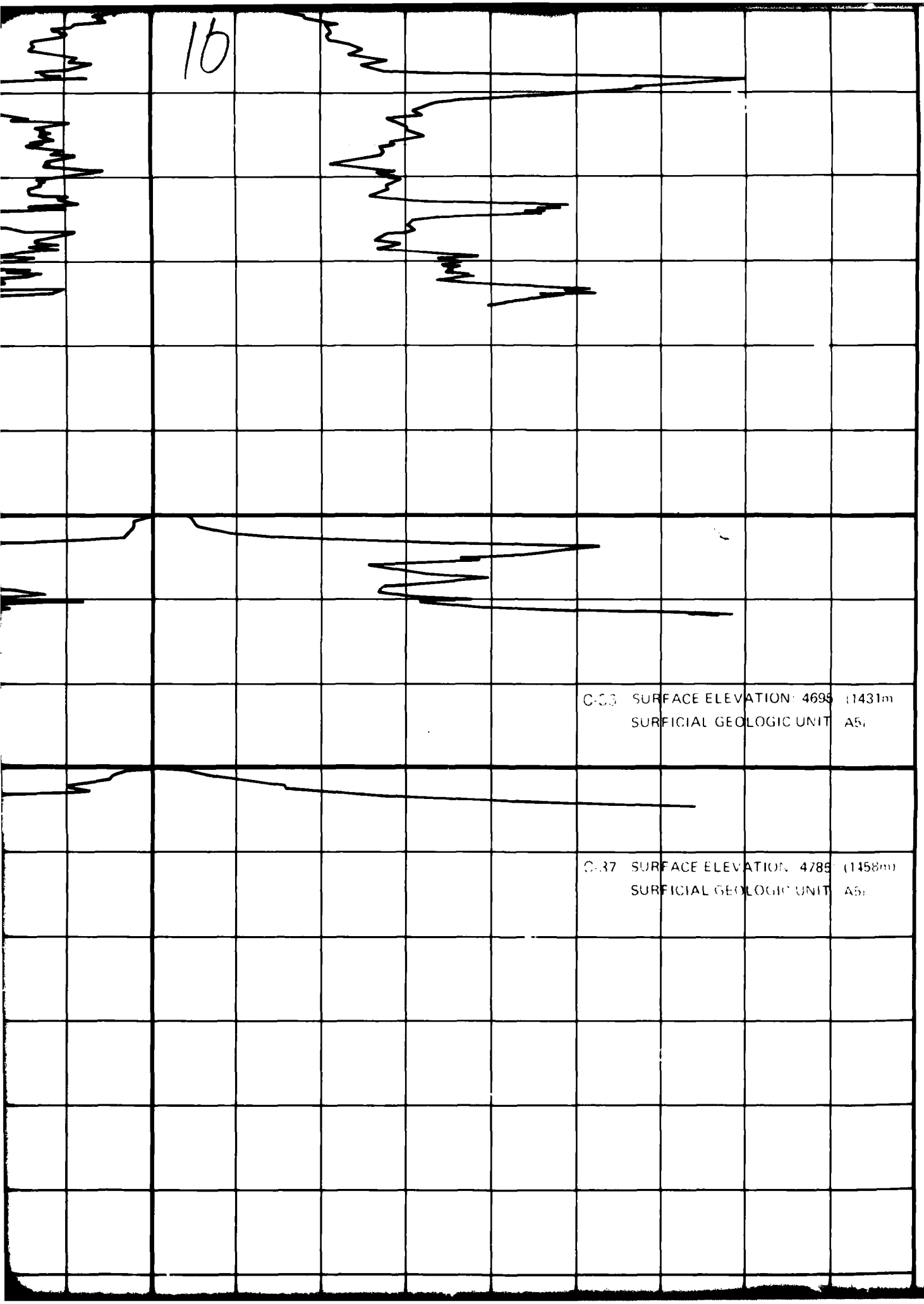

CONE RESISTANCE
2 0 100 200 300 400 500 600 700 800 900 (kg/cm²)
2 0 100 200 300 400 500 600 700 800 900 (tsf)
C 34 SURFACE ELEVATION: 4560 (1390m)
SURFICIAL GEOLOGIC UNIT: As.
C 35 SURFACE ELEVATION: 4645 (1414m)
SURFICIAL GEOLOGIC UNIT: As.

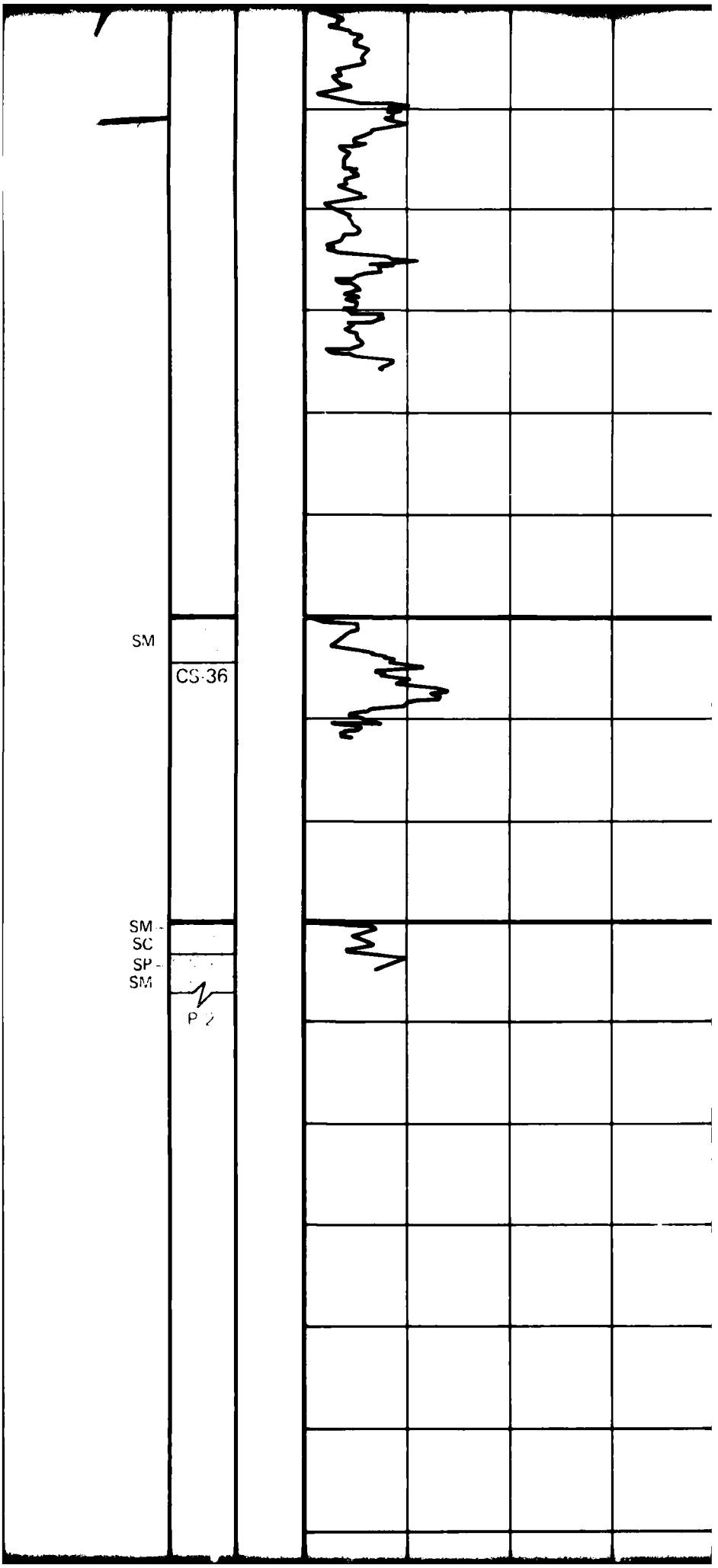

FRICTION RATIO
800
900 (kg/cm2)
800
900 (tsf)
SOIL COLUMN
0
2
4
6
8 (%)
P 1


10
15
20
25
30
0
FRICTION RESISTANCE (13.2 TSF)

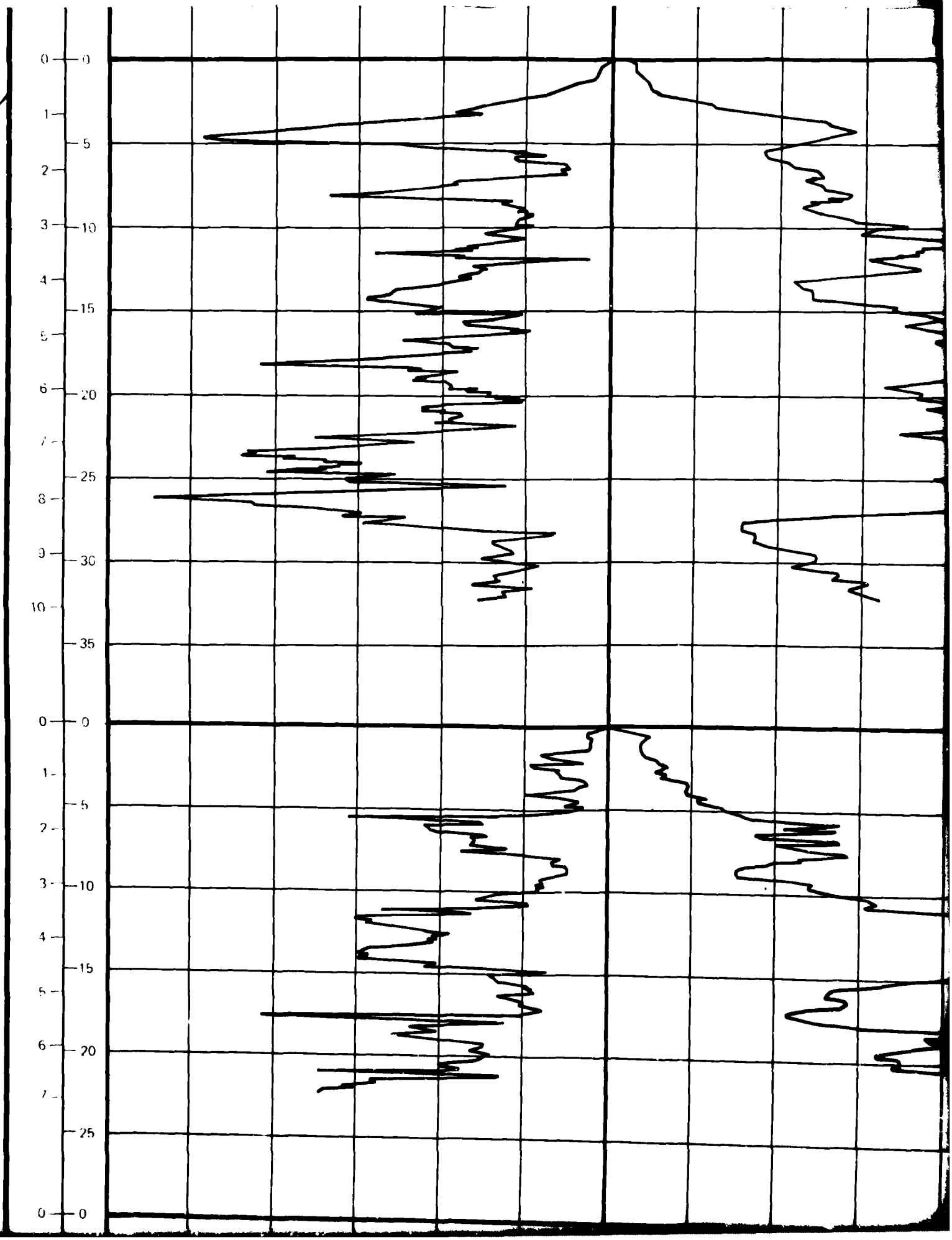

C-29 SURFACE ELEVATION 4505' (1373m)
SURFICIAL GEOLOGIC UNIT: AT
ML
CS 29

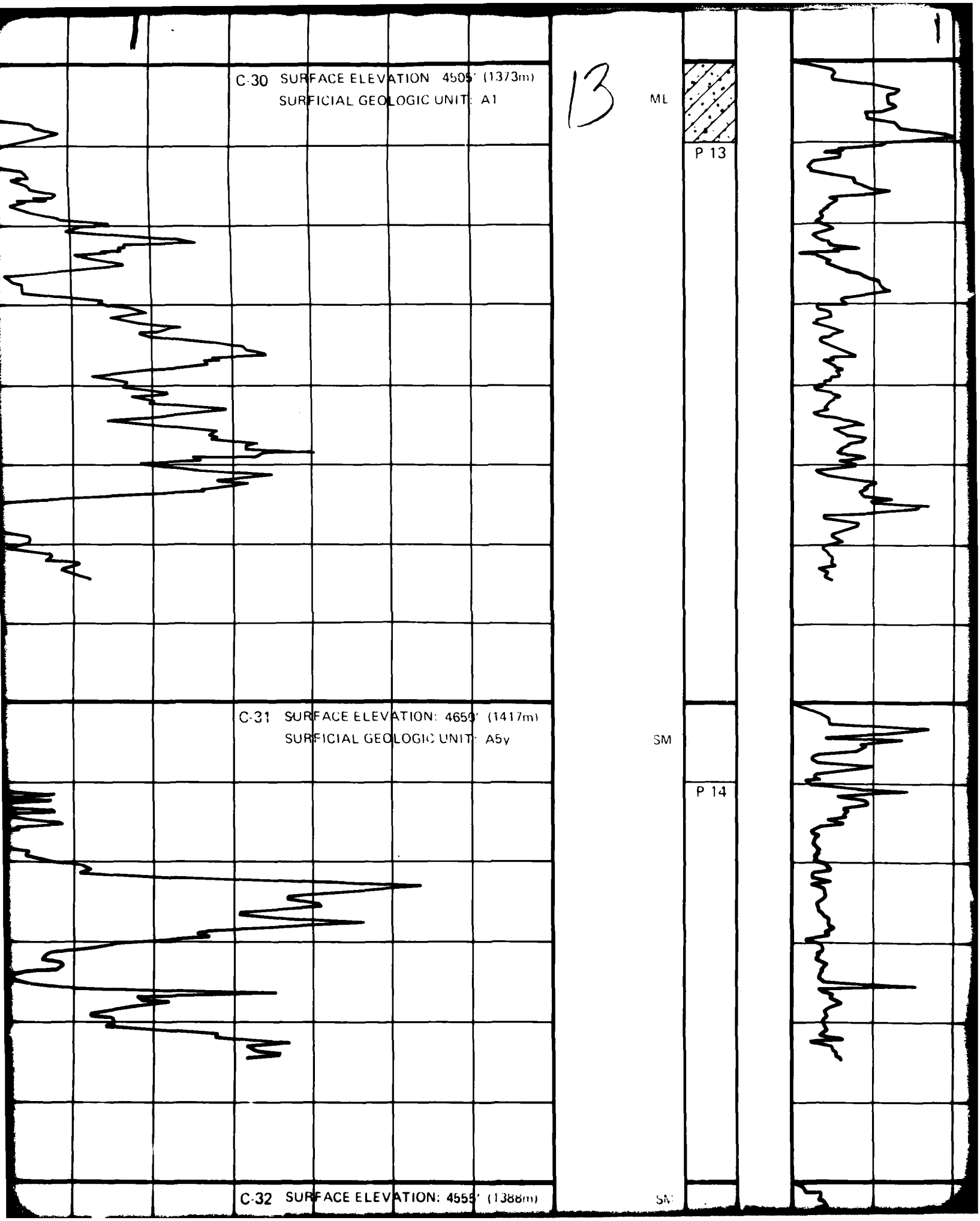

9
15
5
6
20
7
25
8
9
30
10
35
11
0
0
1
5
2
3
-10
0
0
1
5


16
C-33 SURFACE ELEVATION: 4695' (1431m)
SURFICIAL GEOLOGIC UNIT: A5r
C-37 SURFACE ELEVATION: 4785' (1458m)
SURFICIAL GEOLOGIC UNIT: A5r


SM
CS-36
SM -
SC
SP -
SM
P 2

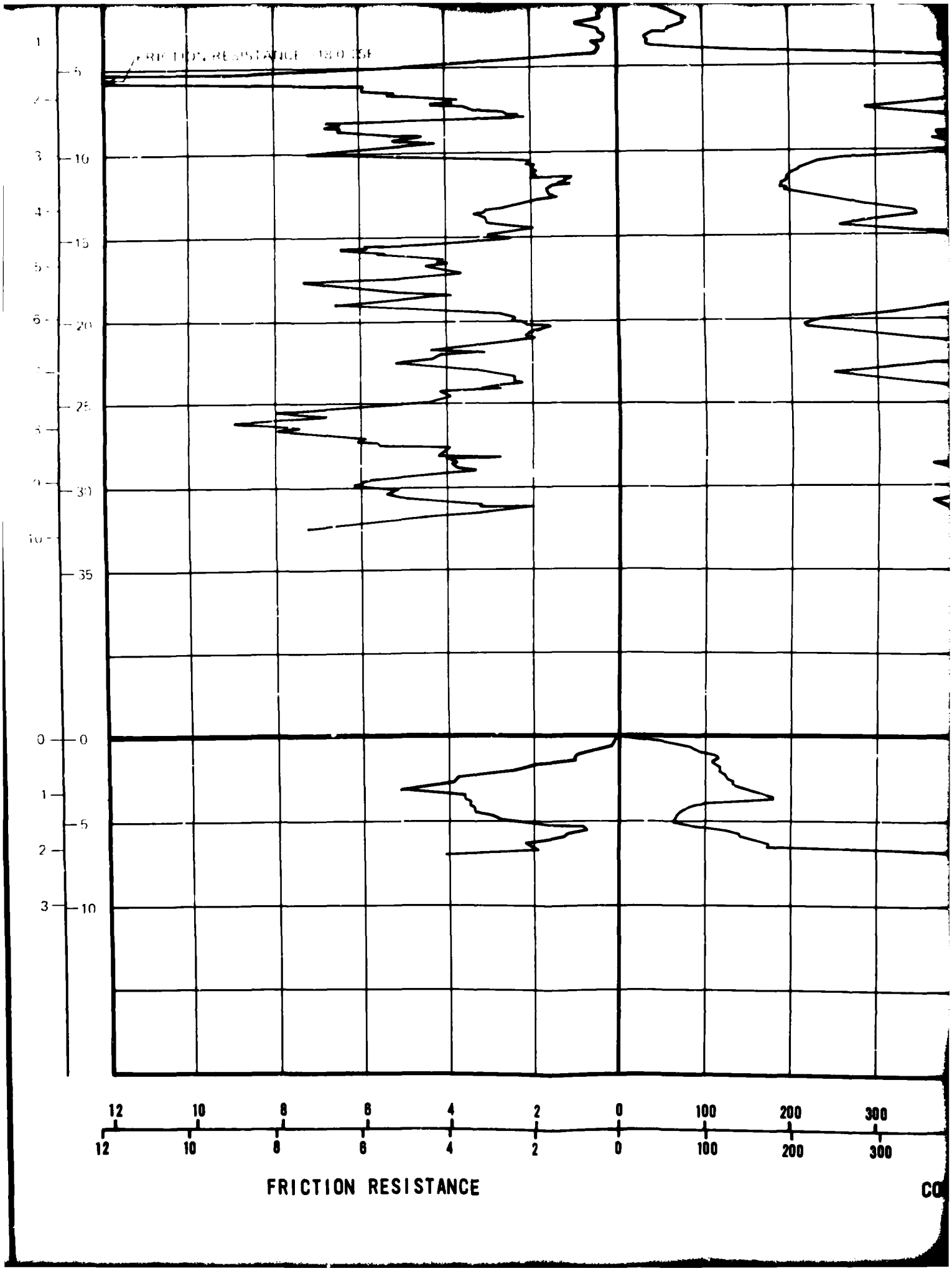
17

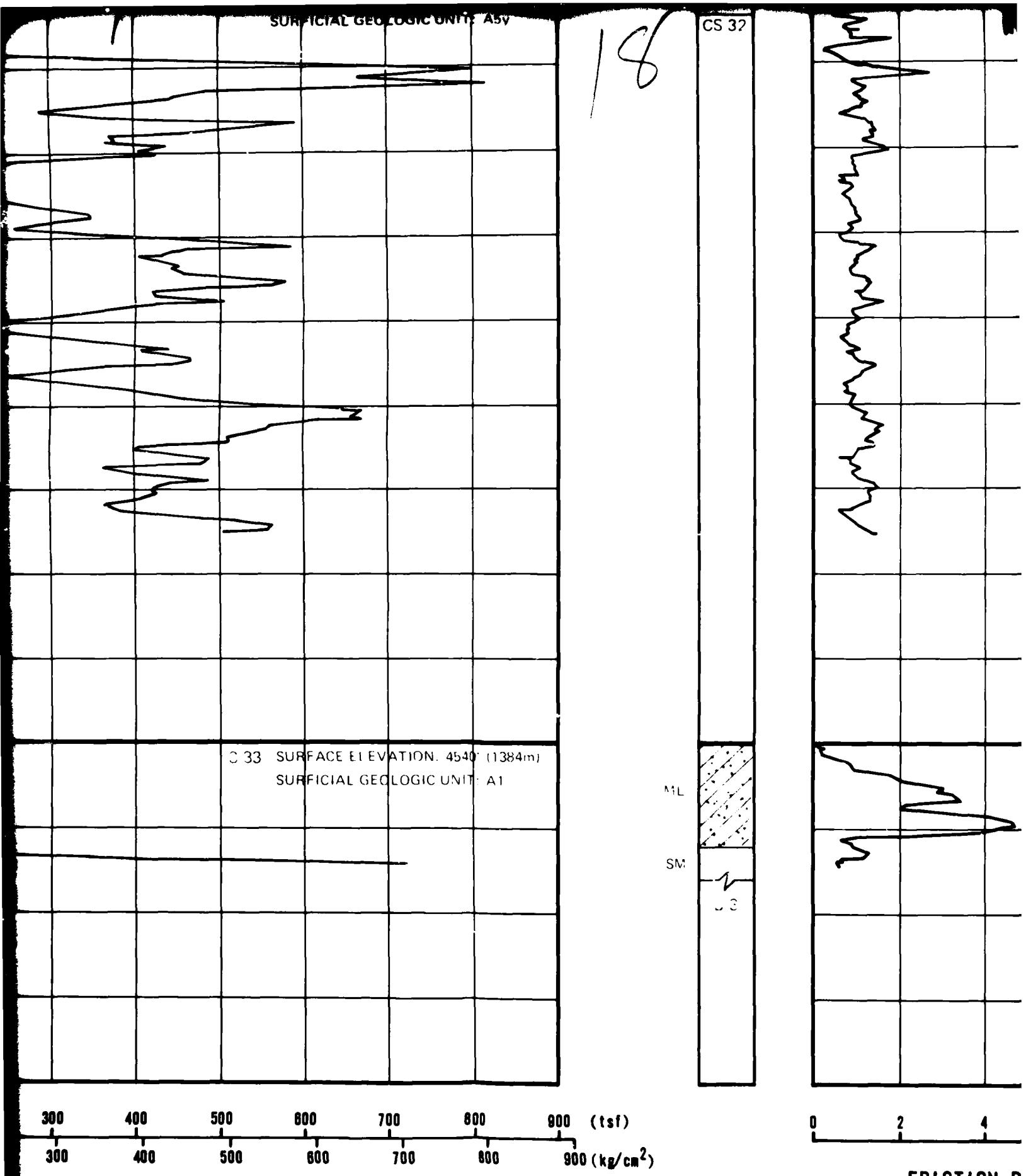


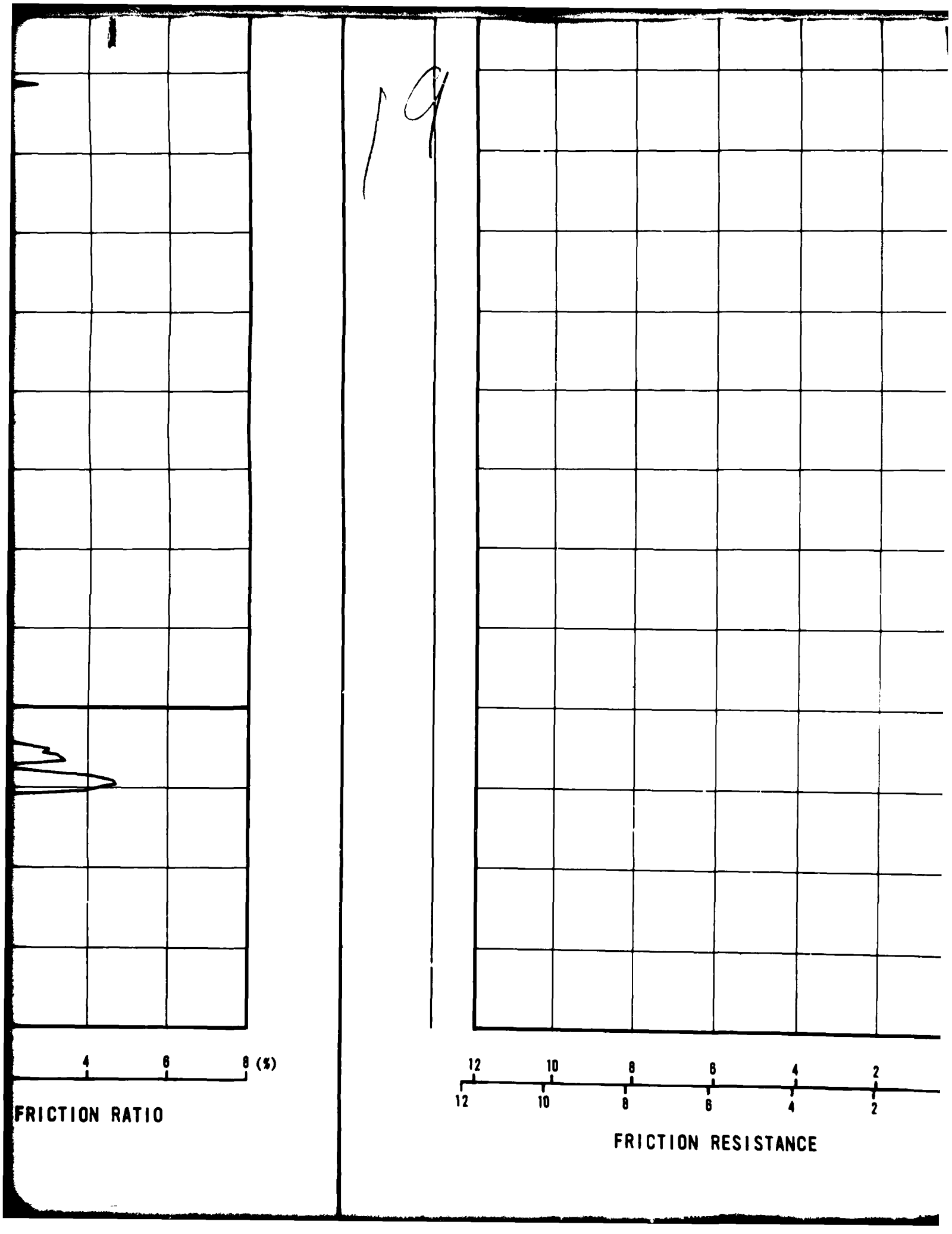

C-30 SURFACE ELEVATION 4505' (1373m)
SURFICIAL GEOLOGIC UNIT: A1
13
ML
P 13
C-31 SURFACE ELEVATION: 4650' (1417m)
SURFICIAL GEOLOGIC UNIT: A5y
SM
P 14
C-32 SURFACE ELEVATION: 4555' (1388m)
SM

14

15


FRICTION RESISTANCE
12
10
8
6
4
2
0
100
200
300
FRICTION RESISTANCE


SURFICIAL GEOLOGIC UNIT: A5v
18
CS 32
C 33 SURFACE ELEVATION: 4540' (1384m)
SURFICIAL GEOLOGIC UNIT: A1
ML
SM
300 400 500 600 700 800 900 (tsf)
300 400 500 600 700 800 900 (kg/cm²)
CONE RESISTANCE
0 2 4
FRICTION R


19
4
6
8 (%)
FRICTION RATIO
12
10
8
6
4
2
12
10
8
6
4
2
FRICTION RESISTANCE

AD-A113 391 FUGRO NATIONAL INC. LONG BEACH CA F/G 13/2
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UNCLASSIFIED FN-TR-27-DM-VOL-2 NL

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A

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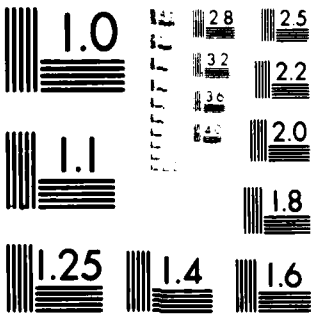
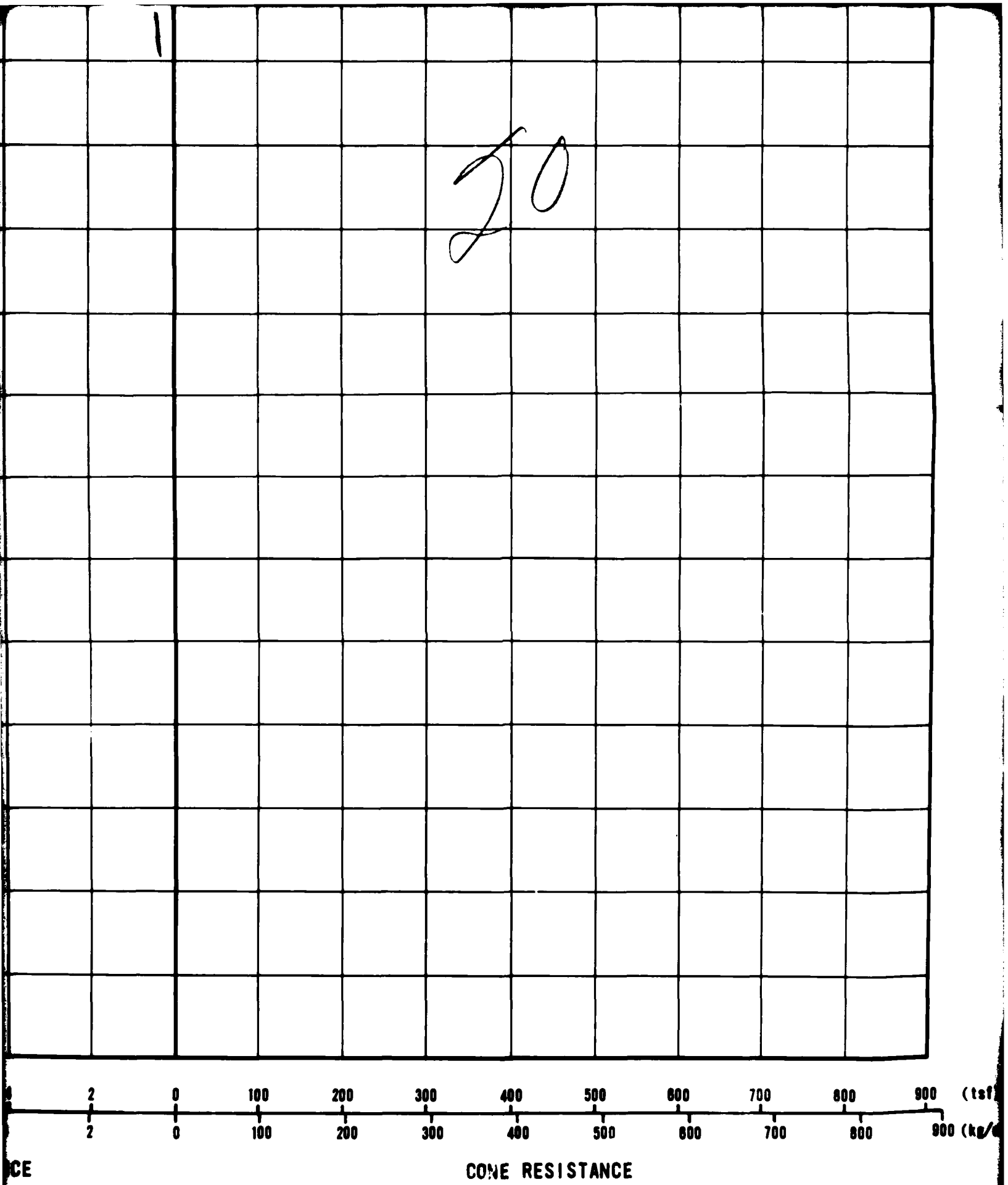
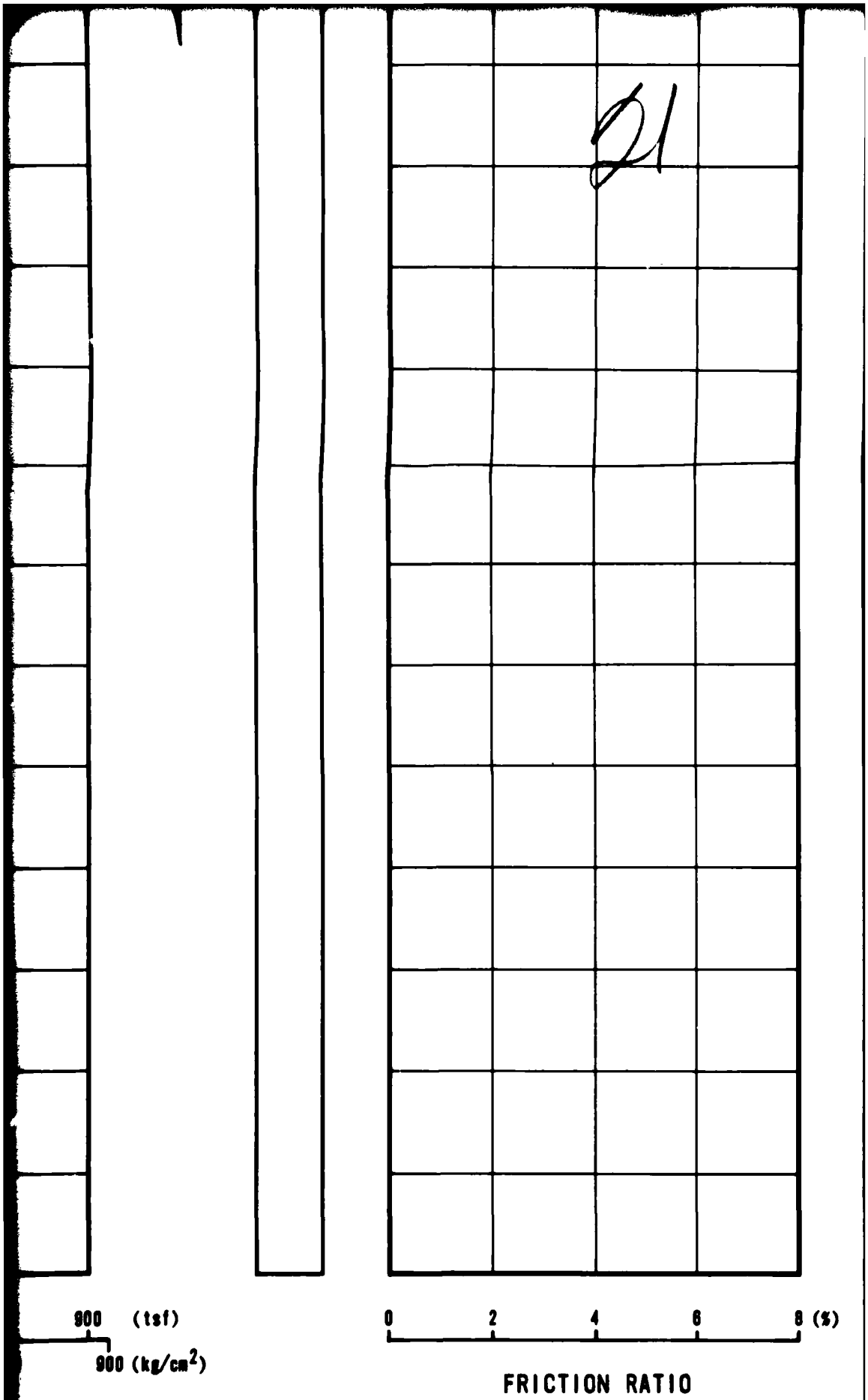
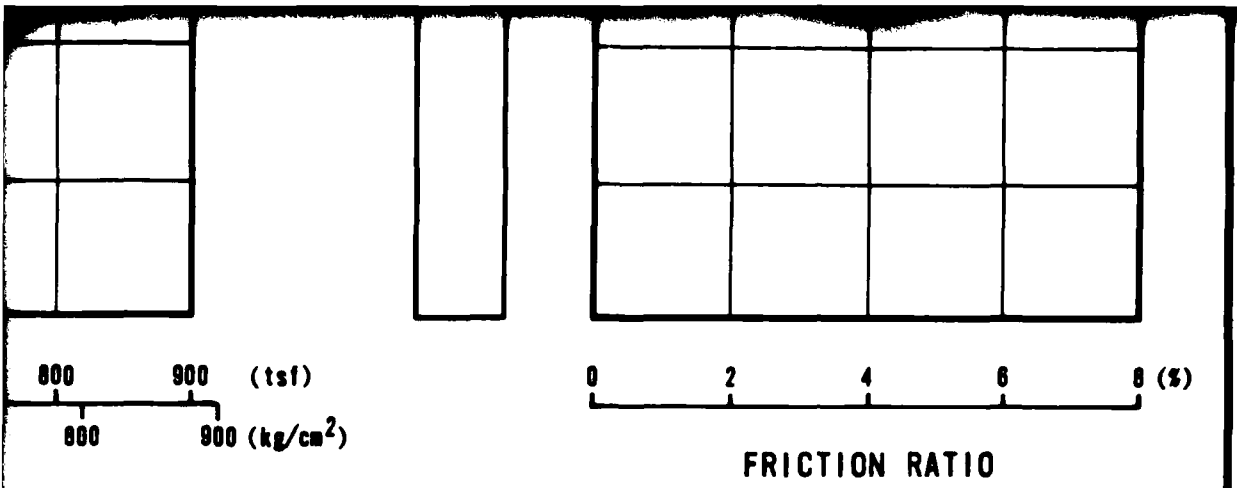


MICROCOPY RESOLUTION TEST CHART


1
20
2
0
100
200
300
400
500
600
700
800
900
(tsf)
2
0
100
200
300
400
500
600
700
800
900
(kg/
CE
CONE RESISTANCE



CONE PENETROMETER TEST RESULTS



CONE PENETROMETER TEST RESULTS
DELAMAR VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

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FUGRO NATIONAL, INC.

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