SOUTH HORSESHOE RIDGE AREA

1987 EXPLORATION PROGRAM

S.E. British Columbia
Part of Coal Lease #4
Kootenay Land District

NTS 82G/15

Latitude: 49° 57 North
Longitude: 114° 45 West

Held by: Shell Canada Limited
Operated by: Crows Nest Resources Limited

Report by: Jeff Schlender,
Senior Geological Technologist
February, 1988

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STATEMENT OF QUALIFICATIONS

Name: Jeff Schlender, Senior Geological Technologist
Concerning: South Horseshoe Ridge Area
Date: February, 1988

The work outlined in this report was undertaken by Mr. Jeff Schlender under the general supervision of Dr. Barry Ryan.

Jeff Schlender received his diploma from Coal Resources Technology, N.A.I.T. in 1978. From 1978 to 1981 he worked for CNRL on various exploration projects which have included Line Creek and Horseshoe Ridge. He supervised and wrote the government submission report entitled, "1979 Geological Report on Horseshoe Ridge." From 1981 to the present he has worked for CNRL at its Line Creek Mine and currently holds the position of Senior Geological Technologist.

Barry Ryan graduated BSc (Hon.) Geology U.B.C. in 1967 and PhD in 1973 also from U.B.C. From 1973 to 1975 he worked on a National Research Council supported Research Fellowship at the University of Witwatersrand, South Africa. In 1976 to 1980 he worked as Research Associate and lecturer at U.B.C. For the past seven years he has worked for CNRL and currently holds the position of Manager, Geology. He has extensive experience in structural geology, coal geology and coal quality.

1.0 INTRODUCTION

1.1 Crows Nest Resources Limited is a wholly owned subsidiary of Shell Canada Limited (Head Office, Calgary, Alberta). Shell acquired Crows Nest Industries in 1978 and with it coal holdings of the original Crows Nest Pass Coal Company which dates back to the late 1800s.

The new company, Crows Nest Resources Limited developed and started production at the Line Creek coal mine in 1981. Mining was initiated at a height of 2074m and the first coal shipments were made in 1982. In 1987 approximately 1.7 million tonnes of clean metallurgical and thermal coal were produced. The mine is a conventional multi-benched truck and shovel open pit operation mining up to six seams synchronously.

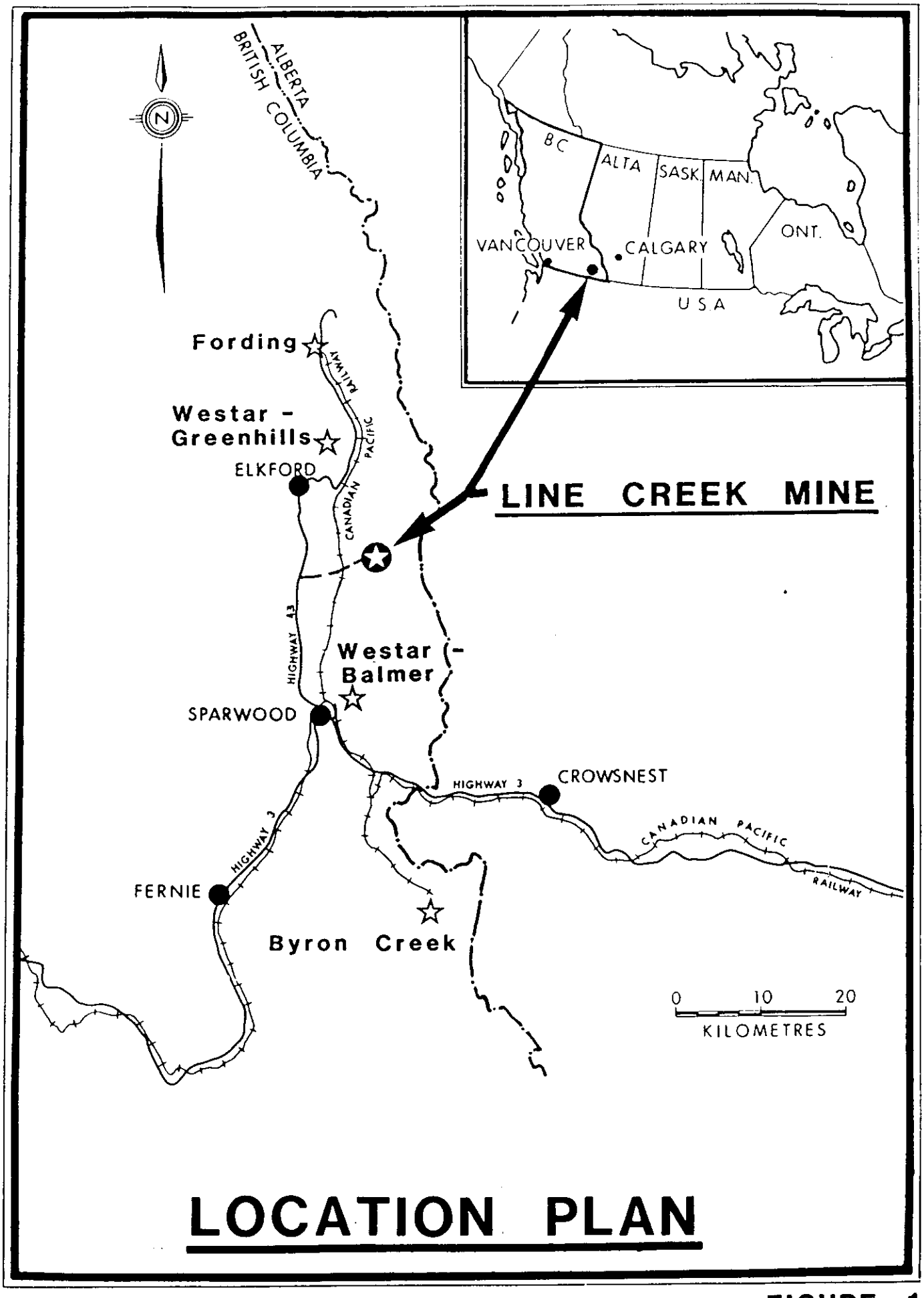
1.2 Location and Access:

The South Horseshoe Ridge Area is on B.C. Mine Lease 4 immediately east of CNRL's Line Creek Mine. The area is approximately 25 km north of the town of Sparwood in southeastern B.C. Access into the area is via the Highway 3 to Sparwood then north on Highway 43 for 18 km to the mine access road (Figure 1). The security gate and Preparation Plant are 5 km east of the turn off and the project area is a further 10 km northeast through the Line Creek canyon (Figure 2).

1.3 Summary of Previous Work:

1969 - 1971 Crows Nest Industries conducted exploration work during these years which consisted of the following:

- geological field mapping
- road construction
- 4 adits into 8 upper and 8 lower seams (177m of drivage)
- Twelve rotary holes for a total meterage of 3089 meters



LOCATION PLAN

FIGURE 1

660 000 m E 114 45

665 000 m E

5 540 000 m N

CROWSNEST FREEHOLD BLOCK

GROUP 330

EWIN PASS

MT. MICHAEL

PROJECT AREA

Coal Lease 4 Bdry.

GROUP 331

TEEPEE

MT. MICHAEL

Upper South Pit

MINE SERVICES BLDG.

HORSESHOE RIDGE

ALBERTA — COLUMBIA

NORTH FORK PASS

Haul Road

Line Creek

No Name Creek

Tornado Creek

Plant Site

Sparwood 40 km (aboard)

CANADIAN PACIFIC RAILWAY

CL284 CL283 CL282 CL1301 CL285 CL286 CL287 CL1300 CL309 CL289 CL288 CL290 CL291 CL292 CL1368 CL294 CL295 CL273 CL297 CL298 CL1369 CL299 CL301 CL300 CL302 CL303 CL370

655 000 m E 114 50

660 000 m E 114 45

665 000 m E

5 540 000 m N

5 535 000 m N

5 530 000 m N

Scale 1:50 000

Kilometres 0.5 0 0.5 1.0 1.5 2.0 2.5 3.0 Kilometres

Miles 0.5 0 0.5 1.0 1.5 2.0 Miles

Contour Interval 100m

Transverse Mercator Projection

Universal Transverse Mercator Grid Zone II

Legend

Road: Highway, Main road

Road: Loose surface, Dry weather

Track or trail

Railway

River

Stream

Contours 2000 1500

Lease Boundary

Lease group boundary

Alexander Creek Syncline

Ewin Pass Thrust

Crows Nest Resources Limited

Site Access & Project Location SOUTH HORSESHOE

AUTHOR BLK | SCALE 1:50 000 | ENCLOSURE No. FIG. 2

DATE FEB 88 | REVISED

(series numbered up to 99).
- air photography

1978 - Crows Nest Resources Limited (CNRL) drilled three diamond core (620m total) (series 100 to 199) holes. The area was again flown for air photography which produced 1:2000 topograhpic maps and air photos on 1:40,000 and 1:20,000 scales.

1979 - CNRL drilled seven rotary holes (1352 meters total) and 3 diamond core holes (835 meters total) (200 series). Also, two adits were cleaned and retimbered for future sampling.

1980 - Work consisted of road construction on the lower west slope, one rotary hole for 294 meters (301).
- Two adits were extended and resampled.
- One new adit (#19) was driven and a bulk sample taken into #7 seam.

1982 - Two phases of work were carried out in 1982. The first phase consisted of developing new cross-sections, bench plans and reserve numbers for a total excavation mine plan. During the second phase of 1982, CNRL drilled nine diamond core holes (400 series for 2595 meters) and produced new cross-sections. The aforementioned work summary was taken from the 1982 Horseshoe Ridge Review by A. White.

1986 - During the latter part of 1986 and early 1987 CNRL engineering department recognized the possible potential for some low cost reserves on the southern end of Horseshoe Ridge. It is this area in which the 1987 exploration work was carried out.

1.4 Summary of Work Done in 1987 Program

- 16 reverse circulation rotary holes for 2641 m (250 to 266 series)
- All holes were geophysically logged and samples were analyzed on 1 meter increments for ash and FSI on raw basis.
- Geological interpretation; 6 sections were constructed, along with an update of the geology base map on 1:2000 scale. Due to the structural complexity of the area, the area was not computer modeled by the main frame MINCOM Miner2 software.

2.0 THE PROJECT

2.1 Objective of the Present Program

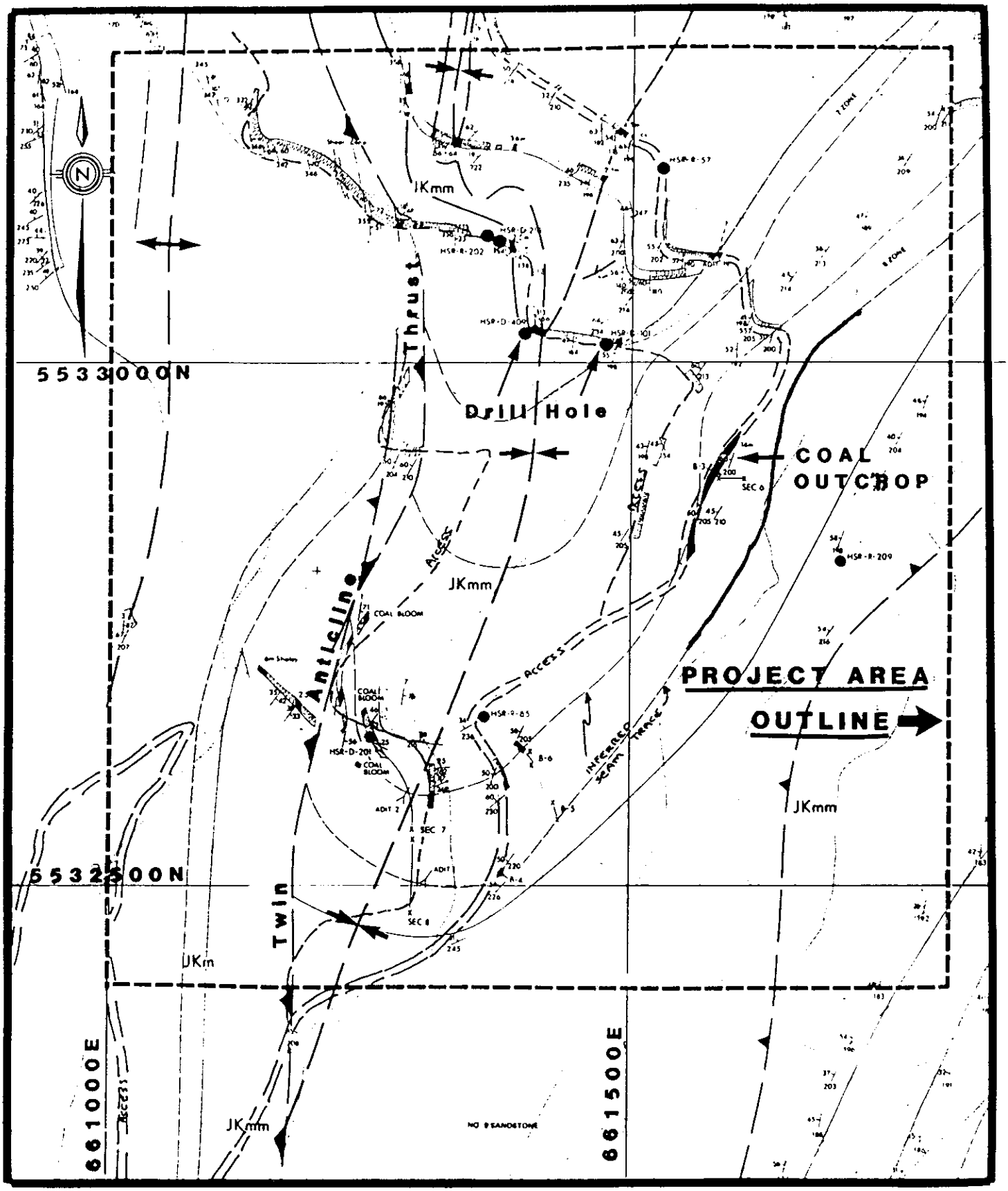
With low prices and an oversupply of metallurgical coal on the world market, CNRL is trying to locate and develop areas of low ratio coal. Because of its proximity to the preparation plant (Figure 2) and potential for low ratio reserves the southern end of Horseshoe Ridge may provide low cost coal.

Although there has been substantial drilling (35 holes, 8785 meters) done on Horseshoe Ridge, only seven holes (1505 meters) have been drilled in the area of interest. It is in this area that CNRL conducted its 1987 exploration work.

2.2 Project Definition

The area of study on Horseshoe Ridge, (Figure 3) has been delineated by the following:

- East and south limits bounded by the base of #8 seam.
- Northern boundary is located at approximately UTM coordinate 5533300 and defined by the waste to coal ratio.
- Western limit has been defined as the top of a sandstone unit presumed to be the Moose Mountain Member of the Morrissey Formation.



PROJECT AREA

SOUTH HORSESHOE RIDGE

Scale 1:5000

FIGURE 3

3.0 GEOLOGICAL OVERVIEW

3.1 Regional Geology:

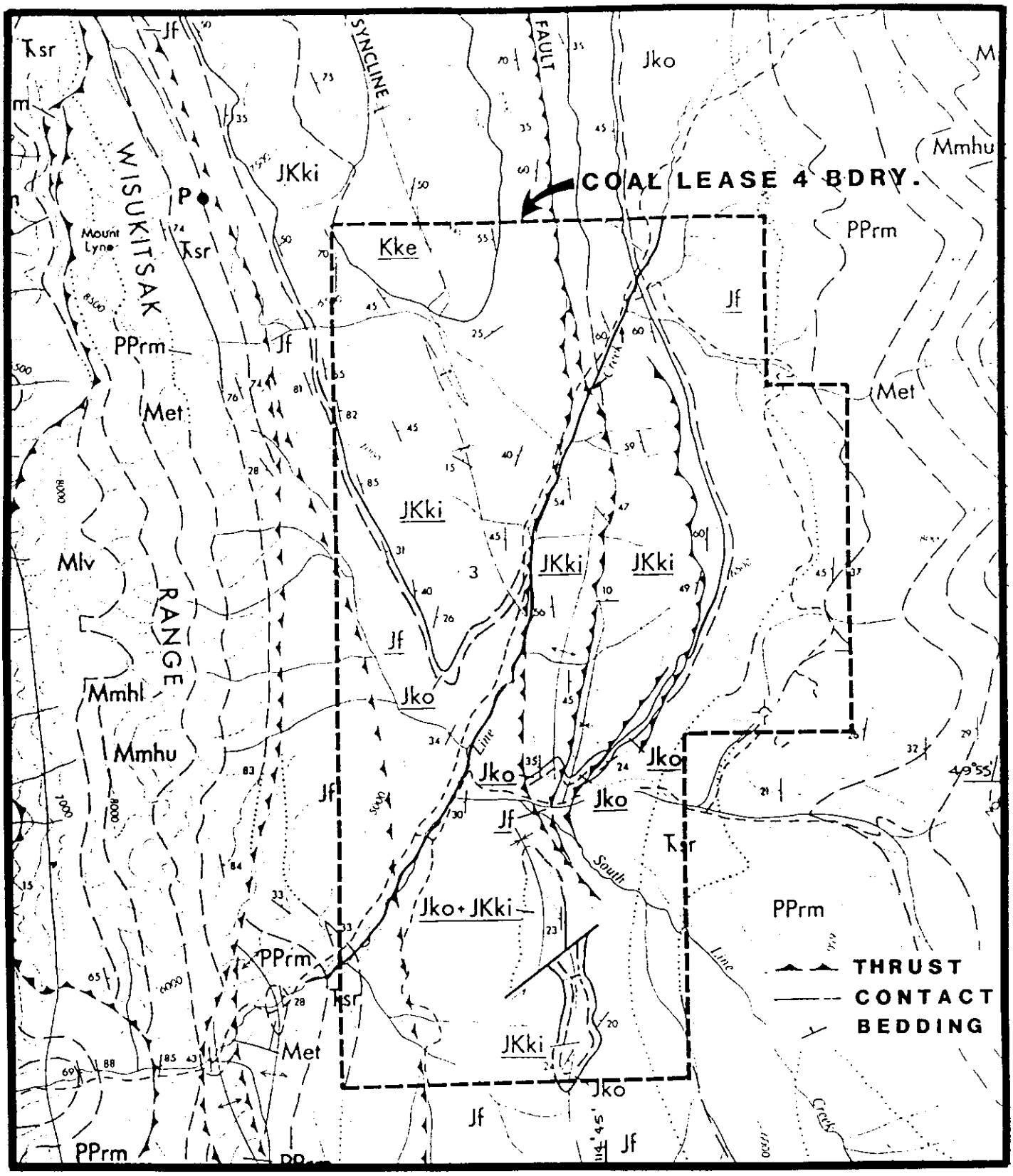
The Line Creek Mine is in the Rocky Mountains, Front Ranges physiographic province of the Eastern Cordillera fold belt. This province is characterized by open shallow plunging north or south trending folds and major thrusts which dip westward and strike north south.

Coal in southeast B.C. occurs in the Jura Cretaceous Kootenay Group which is an eastward thinning wedge of non-marine coal bearing clastic sediments derived from mountains to the south and west. The Kootenay Group is preserved in a number of structurally controlled thrust slices and basins. The Mine Lease #4 occupies part of the Elk Valley Coal Field which is preserved as the core, and east and west limbs of the north trending shallow plunging Alexander Creek Syncline (Figure 4).

3.2 Regional Stratigraphy:

The stratigraphic nomenclature used in this report follows that proposed by Gibson (1979) (Table 1). The Kootenay Group represents a regressive cycle of sediments deposited on the marine shales of the Fernie Formation. As the sea withdrew to the northeast the basal formation of the Kootenay group was deposited; this is a coarse beach derived sandstone (Morrissey Formation). The Morrissey Formation is overlain by the coal bearing deltaic sediments of the Mist Mountain Formation which in turn is overlain by the coarse clastics of the continental Elk Formation.

The Fernie Formation is composed of brown recessive weathering marine mudstones and minor amounts of siltstones and limestones. Phosphate deposits occur within the Fernie Formation but not within Lease 4.



LEGEND

JURASSIC AND CRETACEOUS

KOOTENAY GROUP

Kke — *ELK FORMATION: grey lithic sandstone; siltstone and silty mudstone, humic and sapropelic coal; rare conglomerate*

JKki — *MIST MOUNTAIN FORMATION: dark grey siltstone and mudstone, humic coal; grey lithic sandstone; black carbonaceous shale; rare conglomerate*

JKki - Jki — *MIST MOUNTAIN FORMATION MORRISSEY FORMATION: undivided*

Jko — *MORRISSEY FORMATION: light grey sandstone, locally conglomeratic; carbonaceous shale and coal*

REGIONAL GEOLOGY

Coal Lease 4

SCALE 1:50 000

KILOMETRES 0 1 2 3 4 5 KILOMETRES

PART OF

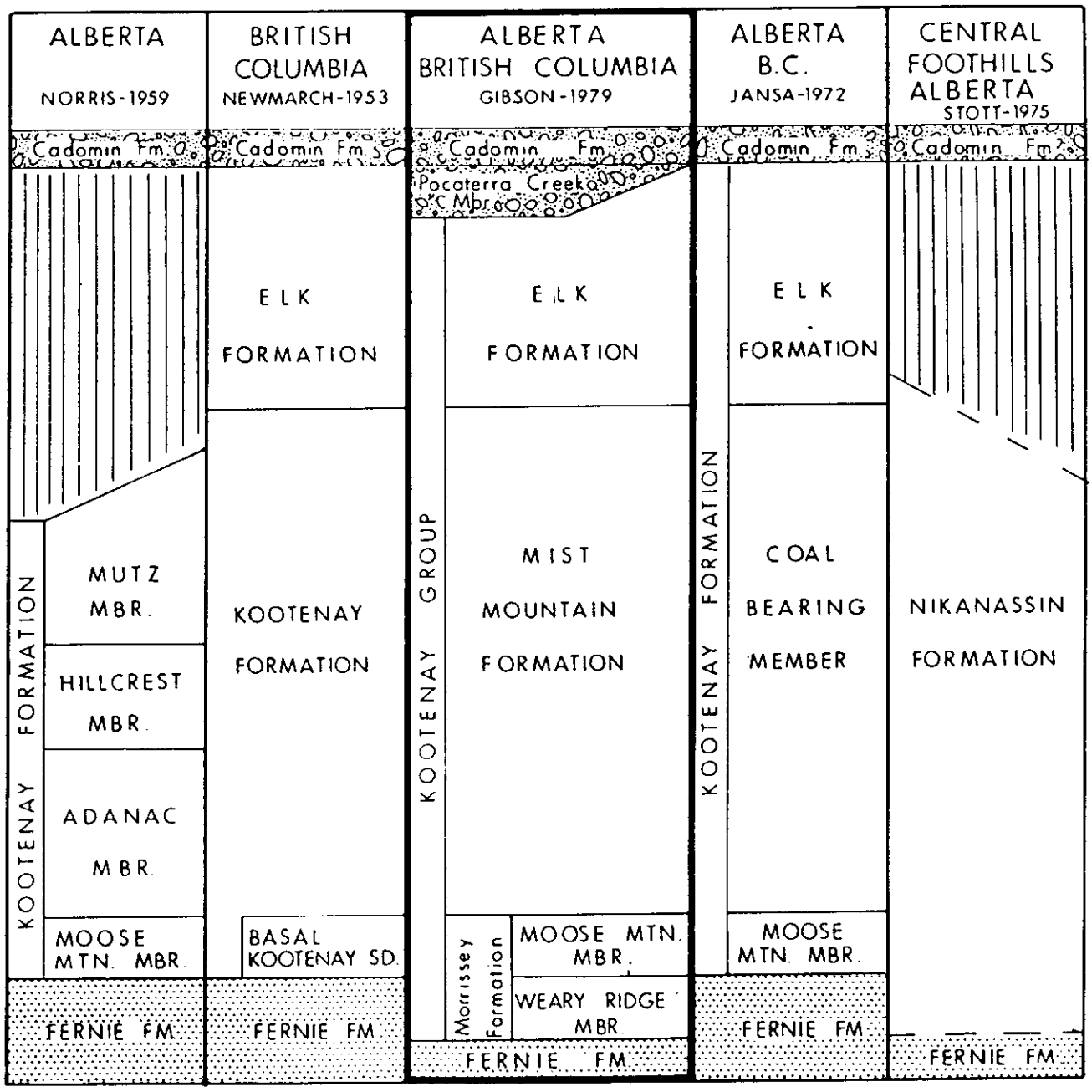
Ministry of Energy, Mines and Petroleum Resources

PRELIMINARY MAP 63

FIGURE 4

TABLE OF FORMATIONS

Nomenclature of the Kootenay Group (after Gibson, 1979)



CROWS NEST RESOURCES

TABLE 1

The Morrissey Formation is an upward coarsening marine or beach sandstone which is subdivided into two members. The lower Weary Ridge Member is composed of fine to medium grained planar thin bedded argillaceous sandstone. The member weathers an orange colour and averages 30 meters thick. The upper Moose Mountain Member is a grey weathering medium to coarse grained thick-bedded to massive sandstone approximately 20 meters thick. It is cliff forming and makes a good mappable unit for the base of the coal bearing sequence.

The Mist Mountain formation is the economically important coal bearing formation in the Kootenay Group. It is composed of siltstone, sandstone, mudstone, shale and coal. The Mist Mountain strata was deposited within sub-aerial portions of deltas and coastal alluvial plains. The sediments are mostly fine grain flood plain derived though in places they are cut by lenticular coarse grained sandstone bodies representing river channel deposits. Coal seams occur throughout the Formation; seams near the bottom of the Formation are laterally persistent and thick, where as seams in the upper part of the Formation are thinner and discontinuous. At Horseshoe Ridge the Mist Mountain Formation is 445 meters thick and contains an average of 60 meters of coal.

The rank of the coal grades from medium volatile bituminous at the base of the section (Ro max values about 1.37 for 10 seam) to high volatile bituminous at the top of the section Ro max values about 1.05 for 2 seam.

The Elk Formation consists of a cliff forming succession of buff weathering sandstones, siltstones, and mudstones. Thick conglomerates and thin seams of needle coal are characteristic of the ELk Formation. The Elk Formation is eroded from the stratigraphic section within Lease 4 but outcrops to the north.

4.0 HORSESHOE RIDGE (MINE LEASE 4)

4.1 Geology:

The regional geology on Lease 4 is defined by a north trending syncline of coal bearing Mist Mountain Formation sediments on the west half of the lease, thrust up against another syncline of Mist Mountain on the east half of the lease (Figure 4). The north south trending break between the two synclines is the Ewin Pass Thrust and a number of steep dipping trailing splay thrusts developing off the top surface of the Ewin Pass Thrust. The most prominent and most westerly being the Mt. Michael Thrust. Reserves are defined, and mining is taking place, on the west limb of the western syncline (Alexander Creek Syncline). Activity is now extending eastward across the axis of the Alexander Creek Syncline into an area in which the rocks are influenced by the Ewin Pass Thrust and its splays (Mt. Michael Ewin Pass Thrust Slice).

The geometry of the Alexander Creek Syncline is that of an assymetric north plunging syncline in the sedimentary pile overlying the west dipping Ewin Pass thrust. The syncline has a west limb which dips at 90° or is overturned at higher elevations. At lower elevations and closer to the hinge of the syncline dips in the Moose Mountain member flatten out. The east limb is partially truncated by the Ewin Pass Thrust but where preserved has west dips ranging up to 65°. The plunge of the fold axis is north or northwest and within the mine lease plunges vary from 5° to 15° northwest.

The over steepening of the west limb of the Alexander syncline in the mine lease may be caused by a thrust in the Fernie Formation to the west, which prior to erosion would have overlain the higher elevations of the west limb, such a thrust is outlined on preliminary map 63 (BCEMPR 1987). The less competent mudstones and coal measures may have been cut by leading splay thrusts rather than have been over-steepened.

Local west directed thrusts are visible in the highwall. These thrusts could represent movement out of the core of the syncline during folding or be blind thrusts associated with underlying east directed thrusts. The combination of the two thrusts forming a triangle zone.

East of the Ewin Pass thrust and across the Line Creek valley is the Horseshoe Ridge syncline. The Moose Mountain member on the east limb of the syncline forms the back of the north trending Horseshoe Ridge. Approximately the lower half of the Mist Mountain Formation is preserved on Horseshoe Ridge as the east limb of the syncline. On the lower slopes to the west some of the west limb is preserved but in this area the geology is complicated by a number of thrusts. The structure on Horseshoe Ridge is in many respects the mirror image of the structure on the Line Creek extending down to the Mt. Michael Thrust.

The Alexander Creek syncline and Mt. Michael Ewin Pass Thrust Slice both extend north across No Name Creek. There is less data available in this area and the structural interpretation is less detailed.

The aforementioned text was taken from the report by B. Ryan, Mt. Michael Ewin Pass Thrust Slice, 1987 Exploration Program.

5.0 SOUTH HORSESHOE RIDGE AREA

5.1 Stratigraphy:

The upper part of the Mist Mountain Formation is eroded on Horseshoe Ridge. Coal seams are numbered in sequence from number 10 at the base of the Formation to number 6 in the upper part of the Formation. Above number 6 four seams of greater than one meter in thickness have been encountered, however, no correlation of these seams has been attempted.

Seams of economic interest in the study area are numbered 7U, 7L, 8U, 8L. The 7U and 7L seams are separated by interbedded siltstones and shales with an average of 9 meters of coal in 20 meters of section.

The 8U and 8L seams have a total of 18 meters of coal in 25 meters of section. These seams often contain shale splits of greater than one meter and are then sub-divided into A, B, and C units.

5.2 Structure

Horseshoe Ridge forms part of the east limb of the Alexander Creek syncline and is characterized by complex folding and faulting. The west side of the study area contains steep dipping to overturned beds whereas the east limb dips 40 - 55° west, forming a dip slope. Exploration to date in the study area, has consisted of rotary drilling, two diamond core holes, two adits and geological mapping on a 1:2000 scale. Drill hole particulars for the 1987 program are listed in Table 2.

On the east limb, the coal measures are fairly continuous striking 0 - 20° dipping 45 - 55° west and shallow out toward the syncline axis. The syncline axis trends north, south with a 10 - 30° northward plunge.

TABLE 2

SOUTH HORSESHOE RIDGE AREA

DRILL HOLE PARTICULARS

HOLE	TYPE	LENGTH	N	E	EL.	ORIENTATION	LOGS
250	rotary	152.0	5532710.2	661237.1	1663.8	090/50	gamma
251	"	176.9	5532794.6	661324.9	1658.8	000/90	gamma, neutron
252	"	234.8	5532912.5	661295.9	1655.1	000/90	gamma, neutron
253	"	164.0	5533027.0	661399.3	1710.4	270/60	gamma, neutron
254	"	159.0	5533119.4	661364.9	1700.6	271/55	gamma, neutron
255*	"	257.0	5533025.5	661402.5	1709.4	000/90	gamma, to TD neutron to 170 m
256	"	176.0	5532912.8	661300.4	1654.2	084/50	gamma
257	"	126.0	5533028.9	661622.4	1770.1	000/90	gamma, neutron
258	"	108.8	5532882.7	661511.3	1725.2	000/90	gamma
259	"	94.0	5532787.1	661488.6	1732.0	000/90	gamma
260	"	127.0	5532706.2	661424.3	1736.3	000/90	gamma
261	"	200.0	5533025.0	661405.9	1709.3	090/50	gamma
262	"	234.2	5532811.0	661324.7	1656.8	270/50	gamma
263	"	121.0	5532813.4	661327.2	1657.3	090/50	gamma
264	"	176.0	5532711.3	661236.0	1663.8	270/55	gamma
266	"	134.0	5532914.3	661302.9	1654.0	265/45	gamma

* hole 255 is a duplicate of diamond hole #409.

Along the synclinal axis and to the west of it, the coal measures are complexly folded and faulted. Lack of outcrop and core data, make correlation across the fault with the east limb extremely difficult. West of the fault future exploration should be carried out.

5.3 Coal Quality

Coal samples from the 1987 program were collected in one meter increments and analyzed for raw ash and FSI at the CNRL lab. Weighted ash values were then calculated for specified seam intersections along with mathematical FSI values. Specific drillhole results are shown in Table 3. Because of sparse drillhole control, all drillhole quality has been used not just the 1987 program. Average seam data was then generated from Table 3 as shown in Table 4.

Additional testing was done on three rotary drillholes in 1987. This information is shown in Table 5. The far right column indicates 60 representing a 1.6 SG wash, the next left column (RC/YD) provides yield data on wash line (W under column TP).

Petrographic analysis was also carried out by David E. Pearson and Associates on 8U seam in drillhole 255. Total reactives are 63.5%, total inerts are 36.5% and mean maximum reflectance is 1.34%.

TABLE 3

SOUTH HORSESHOE RIDGE AREA

COAL QUALITY DATA

HORSESHOE RIDGE PIT AREA QUALITY 880126

HL	SEAM	TOP	TO	TP	ADM	ASH	VOLS	FC	FSI	C.V	S%	RC/YD	SG
55	8U	76.5	87.7	R	-1	20.6	-1	-1	2.5	-1	-1	-1	45
56	8U	88.7	99.8	R	-1	27.1	-1	-1	2.0	-1	-1	-1	45
56	8L	122.8	134.2	R	-1	39.3	-1	-1	1	-1	-1	-1	45
56	8RI	138.5	142.1	R	-1	28.5	-1	-1	1.5	-1	-1	-1	45
57	7U	62.5	66.9	R	-1	24.8	-1	-1	6.5	-1	-1	-1	45
57	7U	71.8	76.2	R	-1	-1	-1	-1	4.5	-1	-1	-1	45
57	7L	79.6	91.4	R	-1	21.2	-1	-1	3	-1	.37	-1	45
57	8U	196.6	205.5	R	-1	30.5	-1	-1	2	-1	-1	-1	45
57	8L	224.3	237	R	-1	28	-1	-1	2	-1	-1	-1	45
-9 line 20	7U	11.1	12.1	R	-1	53.8	-1	-1	.5	-1	-1	-1	45
58	7L	44	45.8	R	-1	37.2	-1	-1	1.5	-1	-1	-1	45
58	8U	147.1	160.2	R	-1	44.7	-1	-1	4	-1	-1	-1	45
58	8L	191.3	203	R	-1	48.2	-1	-1	2.5	-1	-1	-1	45
65	8U	53.1	59.9	R	-1	26.9	-1	-1	4	-1	-1	-1	45
65	8L	86.1	96.6	R	-1	28.6	-1	-1	1.5	-1	-1	-1	45
65	8RI	100.1	102	R	-1	38	-1	-1	1	-1	-1	-1	45
67	4L	50.3	53.3	R	-1	44.8	-1	-1	0	-1	-1	-1	45
67	6L	76.4	81	R	-1	28.2	-1	-1	1	-1	-1	-1	45
67	7U	141.3	148.7	R	-1	38.1	-1	-1	4.5	-1	-1	-1	45
67	7L	174.7	178.0	R	-1	40.9	-1	-1	3.5	-1	-1	-1	45
67 line 40	8U	278.1	291.2	R	-1	20	-1	-1	2.5	-1	-1	-1	45
67	8L	307.5	320.2	R	-1	22	-1	-1	2	-1	-1	-1	45
7	8RI	324.5	326.6	R	-1	27	-1	-1	5.5	-1	-1	-1	45

TABLE 3 (con't)

HL	SEAM	TOP	TO	TP	ADM	ASH	VOLS	FC	FSI	C.V	S%	RC/YD	SG
101	8U	98.3	103.8	R	-1	25	-1	-1	3.5	-1	-1	-1	50
101	8L	124.5	129.5	R	-1	23.1	-1	-1	2	-1	-1	-1	50
101	8RI	132.5	133.7	R	-1	25.6	-1	-1	4	-1	-1	-1	50
201	8U	14.2	27.9	R	.5	46.8	15.1	37.6	1	4273	.5	-1	50
201	8L	55.1	79	R	.4	42.4	15.8	41.4	1	4655	.5	-1	50
401	6	111.9	116.8	R	.59	59.8	-1	-1	-1	-1	-1	-1	60
401	7U	158	164.5	R	.75	18	-1	-1	-1	-1	-1	-1	60
401	8U	267	275.5	R	.55	21	-1	-1	-1	-1	-1	-1	60
401	8L	288	298.5	R	.7	28	-1	-1	-1	-1	-1	-1	60
09	7U	53.1	59.5	R	.88	46.5	-1	-1	-1	-1	-1	-1	60
ine	20												
409	7M	75.1	77.5	R	.77	42.3	-1	-1	-1	-1	-1	-1	60
409	7L	85.4	87.8	R	.73	12.8	-1	-1	-1	-1	-1	-1	60
409	8U	198.1	207.7	R	.63	27.9	-1	-1	-1	-1	-1	-1	60
409	8L	229.3	241.8	R	.58	25.2	-1	-1	-1	-1	-1	-1	60
250	8U	19.8	30.6	R	-1	27.7	-1	-1	2.5	-1	-1	-1	-1
250	8U	58	73	R	-1	38.4	-1	-1	2.5	-1	-1	-1	-1
250	8L	95.4	105.4	R	-1	28.5	-1	-1	2	-1	-1	-1	-1
250	8L	110.4	119.6	R	-1	27.1	-1	-1	2	-1	-1	-1	-1
250	8RI	122	123.6	R	-1	38	-1	-1	2	-1	-1	-1	-1
251	8U	68.8	78.2	R	-1	31.1	-1	-1	2.5	-1	-1	-1	-1
251	8LA	96.5	98.7	R	-1	33.4	-1	-1	1.5	-1	-1	-1	-1
251	8LB	99.8	109	R	-1	31.3	-1	-1	1.5	-1	-1	-1	-1
251	8RI	112.3	114.5	R	-1	20.2	-1	-1	4	-1	-1	-1	-1
252	8UA	94	100.4	R	-1	36.6	-1	-1	1	-1	-1	-1	-1
252	8UB	109.2	119.2	R	-1	52.4	-1	-1	1	-1	-1	-1	-1
line	40												
252	8UC	120.2	129.4	R	-1	25.9	-1	-1	2.5	-1	-1	-1	-1
252	8UD	138	139.6	R	-1	25.5	-1	-1	4	-1	-1	-1	-1
252	8LA	158.7	161.4	R	-1	31.6	-1	-1	3	-1	-1	-1	-1
2	8LB	169.8	193	R	-1	23.1	-1	-1	1.5	-1	-1	-1	-1
252	8LC	196.4	200.1	R	-1	23.9	-1	-1	1.5	-1	-1	-1	-1
252	8RI	203	206	R	-1	23.8	-1	-1	4.5	-1	-1	-1	-1

TABLE 3 (con't)

HL	SEAM	TOP	TO	TP	ADM	ASH	VOLS	FC	FSI	C.V	S%	RC/YD	SG
253	8UA	54	55.5	R	.4	30.15	-1	-1	5	-1	-1	-1	60
253	8UC	73	79	R	.47	31.39	-1	-1	7.5	-1	-1	-1	60
253	8LA	106.5	108	R	.47	29.76	-1	-1	6.5	-1	-1	-1	60
253	8LC	143.5	149	R	.48	37.3	-1	-1	1.5	-1	-1	-1	60
255	7U	52	56.5	R	.53	32.52	-1	-1	1	-1	-1	-1	60
255	7M	70.5	71.5	R	.37	29.72	-1	-1	1.5	-1	-1	-1	60
255	7L	81.5	84	R	.55	23.28	-1	-1	1	-1	-1	-1	60
255	8U	188	197.5	R	.3	27.1	-1	-1	3.5	-1	-1	-1	60
255	8L	223	232	R	.49	25.88	-1	-1	2.5	-1	-1	-1	60
~56 ne	8U 20	117	125.5	R	-1	34.6	-1	-1	1.5	-1	-1	-1	-1
256	8LB	141	145.6	R	-1	36.6	-1	-1	1.5	-1	-1	-1	-1
256	8LC	147.9	149.5	R	-1	19.6	-1	-1	6	-1	-1	-1	-1
256	8RI	152.3	154	R	-1	46.2	-1	-1	2.5	-1	-1	-1	-1
257	8U	38.2	46.9	R	-1	24.6	-1	-1	2	-1	-1	-1	-1
257	8L	74	84.4	R	-1	25	-1	-1	2	-1	-1	-1	-1
257	8RI	87	89.4	R	-1	32.3	-1	-1	6.5	-1	-1	-1	-1
258	8L	29.3	41.1	R	-1	30.3	-1	-1	1.5	-1	-1	-1	-1
258	8RI	47.8	49.5	R	-1	31.9	-1	-1	4	-1	-1	-1	-1
259	8L	10.5	25.4	R	-1	25.4	-1	-1	0	-1	-1	-1	-1
259	8RI	34.3	36.3	R	-1	41.5	-1	-1	2	-1	-1	-1	-1
260	8U	19.6	28	R	-1	29.5	-1	-1	0	-1	-1	-1	-1
260	8L	61.2	70.8	R	-1	21.7	-1	-1	2	-1	-1	-1	-1
260	8RI	73.6	75.6	R	-1	22.8	-1	-1	6	-1	-1	-1	-1
261	7U	49	50	R	.53	29.64	-1	-1	1.5	-1	-1	-1	60
261	7L	64	65	R	.45	19.48	-1	-1	3	-1	-1	-1	60
261	8U	139	146	R	.34	23.37	-1	-1	2.5	-1	-1	-1	60
263 line	8U 40	55.6	62	R	-1	35.9	-1	-1	2.5	-1	-1	-1	-1
263	8L	86.8	95.8	R	-1	34.7	-1	-1	1	-1	-1	-1	-1

TABLE 4

SOUTH HORSESHOE RIDGE AREA

AVERAGE DRILLHOLE QUALITY

	7U	7L	8U	8L
Drill Thickness (SD)	4.4 (.8)	4.2 (1.9)	8.8 (.7)	9.6 (1.3)
Avg. Raw Ash (SD)	33.5 (4.1)	25.1 (4.5)	32.0 (1.6)	30.5 (1.3)
[redacted]				
Avg. Raw FSI (SD)	3.8 (1.0)	2.7 (.5)	2.4 (.3)	1.6 (.3)
[redacted]				

TABLE 5

SOUTH HORSESHOE RIDGE AREA

1987 COAL QUALITY WASH DATA

HORSESHOE RIDGE 15/12/87

HL	SEAM	TOP	TO	TP	ADM	ASH	VOLS	FC	FSI	C.V	SX	RC/YD	SG
253	8UA	54	55.5	R	.4	30.15	-1	-1	5	-1	-1	-1	60
253	8UC	73	79	R	.47	31.39	-1	-1	7.5	-1	-1	-1	60
253	8LA	106.5	108	R	.47	29.76	-1	-1	6.5	-1	-1	-1	60
253	8LC	143.5	149	R	.48	37.3	-1	-1	1.5	-1	-1	-1	60
255	7U	52	56.5	R	.53	32.52	-1	-1	1	-1	-1	-1	60
255	7M	70.5	71.5	R	.37	29.72	-1	-1	1.5	-1	-1	-1	60
255	7L	81.5	84	R	.55	23.28	-1	-1	1	-1	-1	-1	60
5	8U	188	197.5	R	.3	27.1	-1	-1	3.5	-1	-1	-1	60
255	8L	223	232	R	.49	25.88	-1	-1	2.5	-1	-1	-1	60
261 line 20	7U	49	50	R	.53	29.64	-1	-1	1.5	-1	-1	-1	60
261	7L	64	65	R	.45	19.48	-1	-1	3	-1	-1	-1	60
261	8U	139	146	R	.34	23.37	-1	-1	2.5	-1	-1	-1	60

6.0 SUMMARY

The South Horseshoe Ridge Area has potential for low cost coal reserves which are essential to the long term survival of Crows Nest Resources. The seams of economic interest in the study area are 7U, 7L, 8U, and 8L. Two major thrust faults, defined in the project area, help bring some reserves closer to surface. Little work has been done west of the faults and it is in this area that future exploration work should be conducted.

The cost of study is outlined in Table 6 and include contractor costs, Line Creek equipment, and salary costs where applicable.

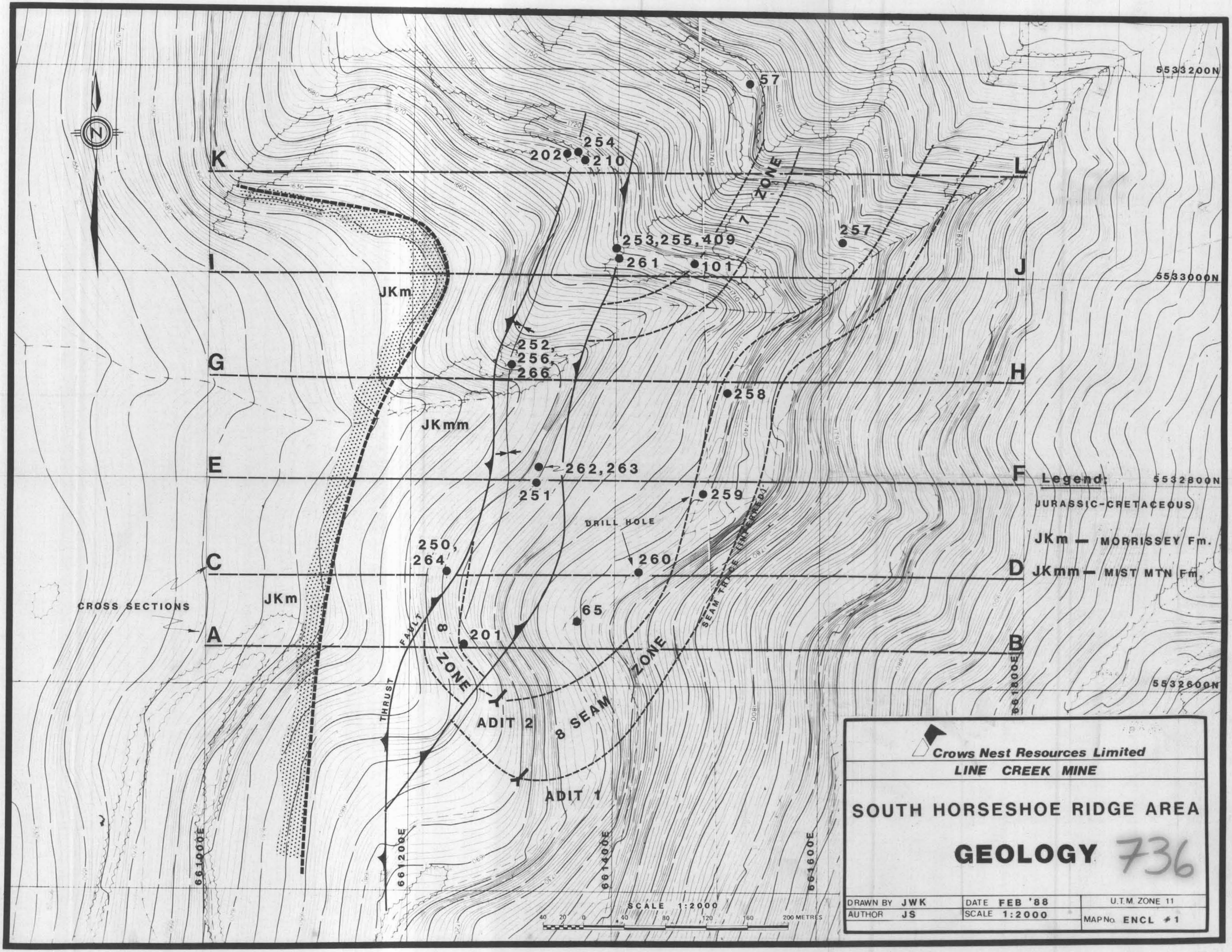
7.0 ACKNOWLEDGEMENTS

The author would like to thank the field assistance of Jan Bannick, the structural guidance of Barry Ryan, the drafting of John Kinnear and typing and report preparation of Marie Ruzek.

8.0 REFERENCES

1. Ryan, B., 1987, Mt. Michael Ewin Pass Thrust Slice

2. White, A., 1982, Horseshoe Ridge Review



Crows Nest Resources Limited

LINE CREEK MINE

SOUTH HORSESHOE RIDGE AREA

GEOLOGY 736

DRAWN BY JWK	DATE FEB '88	U.T.M. ZONE 11
AUTHOR JS	SCALE 1:2000	MAP No. ENCL #1

W

E

1800

1700

1600

1500

1400

65

21m S.

201

8U

8 Upper

8 Lower

JKm

9

10

736

40 20 0 40 80 120

Crows Nest Resources Limited

LINE CREEK MINE

South Horseshoe Ridge Area

STRUCTURAL CROSS SECTION A-B

DRAWN BY: JWK	DATE: FEB '88	
AUTHOR JS	SCALE: 1:2000	MAP No. ENCL. # 2

W 5532710N 61780E

E 5532710N 61780E

1800

1700

1600

1500

1400

260

65

8 Upper

8 Lower

8U

8L

JKm

264

250

736

40 20 0 40 80 120

Crows Nest Resources Limited

LINE CREEK MINE

South Horseshoe Ridge Area

STRUCTURAL CROSS SECTION C-D

DRAWN BY: JWK	DATE: FEB '88	
AUTHOR JS	SCALE: 1:2000	MAP No ENCL. # 3

W

E

1800

1700

1600

1500

1400

JKm

259
4m N.

263
12m S.

262
12m S.

251
5m N.

736

40 20 0 40 80 120

Crows Nest Resources Limited

LINE CREEK MINE

South Horseshoe Ridge Area

STRUCTURAL CROSS SECTION E-F

DRAWN BY: JWK	DATE: FEB '88	
AUTHOR JS	SCALE: 1:2000	MAP No. ENCL. # 4

W 5532900 N 661000 E

5532900N 661780E

E

1800

1700

1600

1500

1400

258
15m N.

8 Upper

8 Lower

8U

8L

266
12m S.

JKm

256
12m S.

252
12m S

736

40 20 0 40 80 120

Crows Nest Resources Limited

LINE CREEK MINE

South Horseshoe Ridge Area

STRUCTURAL CROSS SECTION G-H

DRAWN BY: JWK	DATE: FEB '88	
AUTHOR JS	SCALE: 1:2000	MAP No. ENCL. # 5

W

E

1800

1700

1600

1500

1400

257

32m S

101

25m. S.

18m S.

8 Upper

8 Lower

7 Zone

Ss

253

261

409

JKm

8U

8L

736

40 20 0 40 80 120

Crows Nest Resources Limited

LINE CREEK MINE

South Horseshoe Ridge Area

STRUCTURAL CROSS SECTION I-J

DRAWN BY: JWK	DATE: FEB '88	
AUTHOR JS	SCALE: 1:2000	MAP No. ENCL. # 6

W 5533100N 661000E

5533100N 661780E E

1800

1700

1600

1500

1400

57 90m.S

254 19m. S.

202 23m S.

210 15m S

7

SS

7 Zone

8 Upper

8 Lower

JKm

8U

8L

736

40 20 0 40 80 120

Crows Nest Resources Limited

LINE CREEK MINE

South Horseshoe Ridge Area

STRUCTURAL CROSS SECTION K-L

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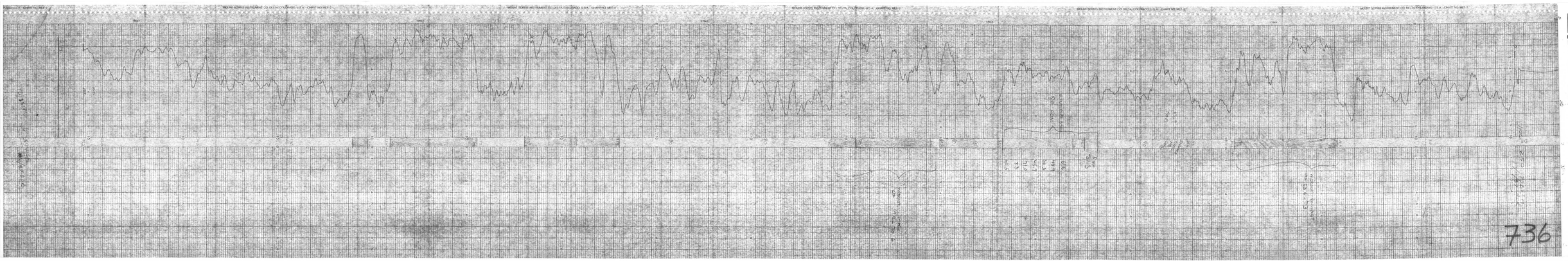
AUTHOR JS	SCALE: 1:2000	MAP No. ENCL. # 7



THRU-RODS

Crowe Nest Resources

BORE 090/50°

HOLE NO. HSR-250

AREA Horsehead Ridge

DATE 971110

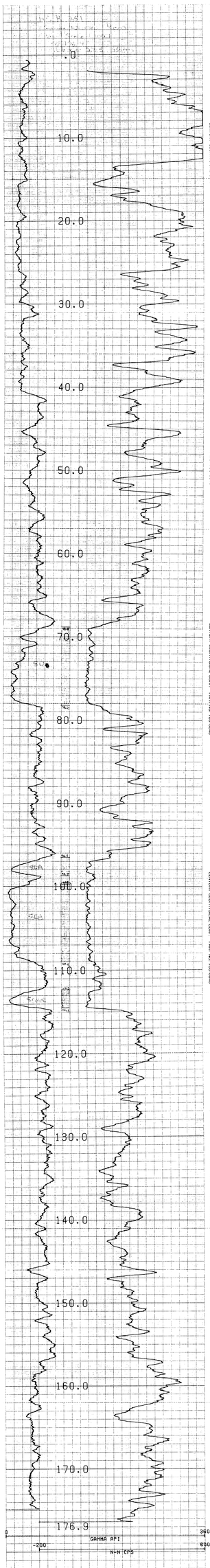
GROUND LEVEL	R 1664
TOTAL DEPTH	152.0
CASING	—
BIT SIZES 1	5¼"
2	5"
CASING SIZE	—
WATER LEVEL	47.0 m

LOG TYPE

LOG	CORE GAMMA
PROBE NO.	1078
CHART RATIO	1001
CPS	10
FIRST READING	152.0
LAST READING	—
INTERVAL LOGGED	—
ENGINEER	BARRY RYAN

SEAM DEPTHS

DEPTHS FROM	DEPTHS TO	SEAM NO
19.8	30.6	S3
58.0	61.6	S2
84.4	91.0	S1
95.4	105.9	S1L
110.4	119.6	S1L
123.0	133.6	S1U



COMPU-LOG YBL2 PLOT 07-10-91

736

R 251

CROWS NEST RESOURCES

HORSESHOE RIDGE BC

HOLE DIAMETER = 12.4

PROBE # 9055A - 010

SENSOR #4 CAL STD CPS = 152

SENSOR #4 CAL RUN CPS = 160

SENSOR #4 CAL BIAS = 0

DATE 931294 TRUCK # 7920

D. BOMBACK APPL.#7 L1

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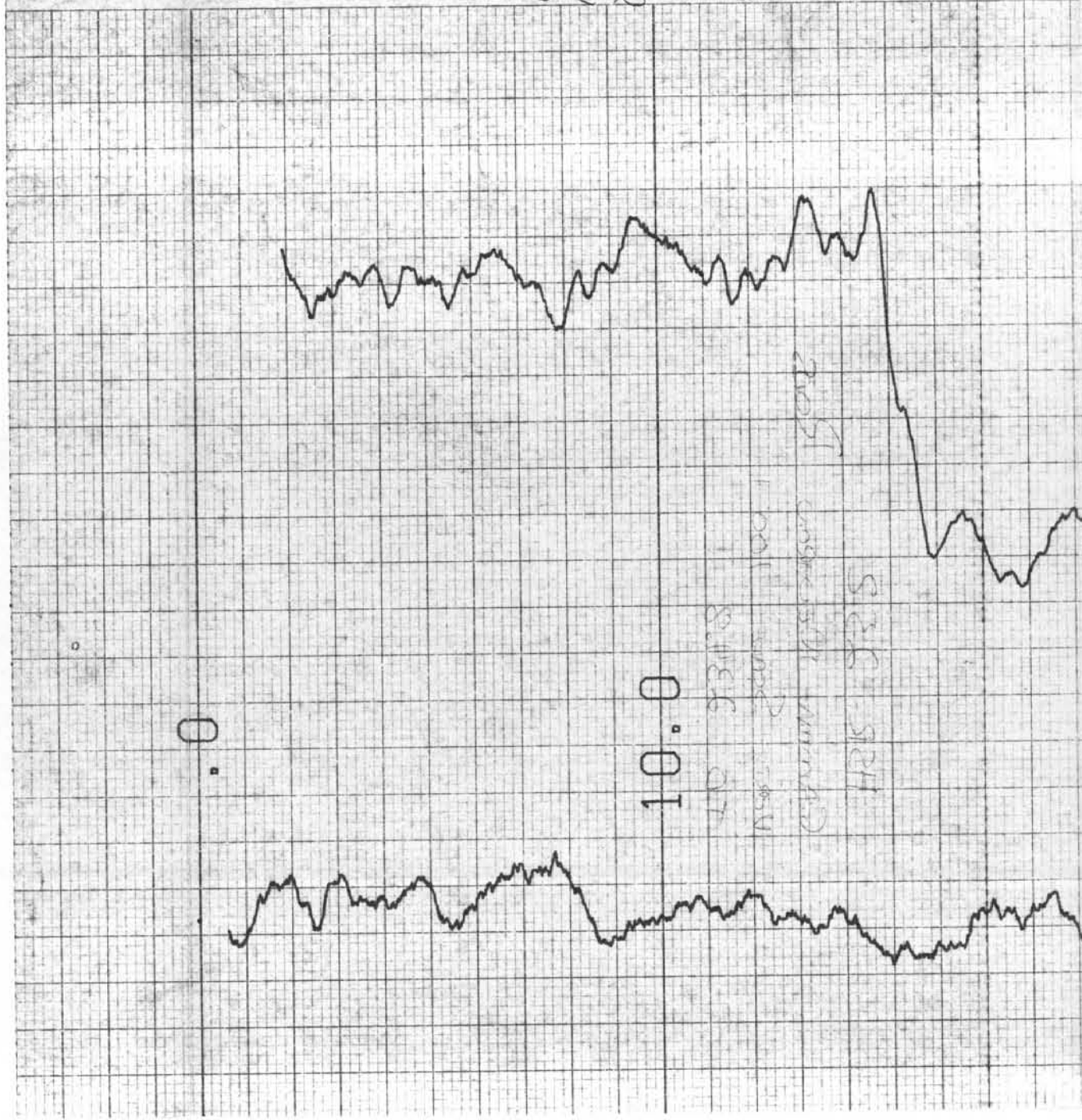
CENTURY GEOPHYSICAL CORP. PART NO. 786-0040



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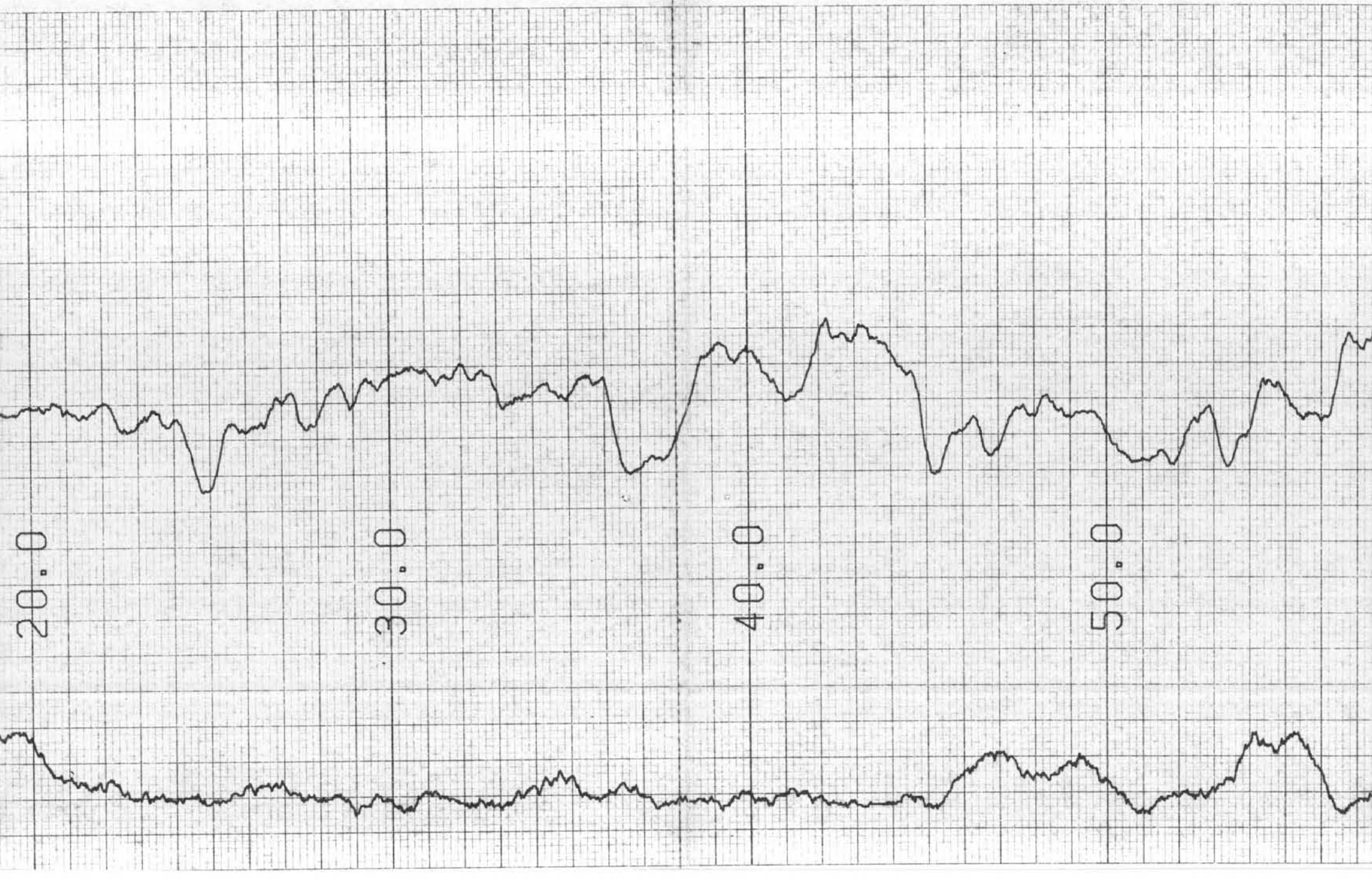

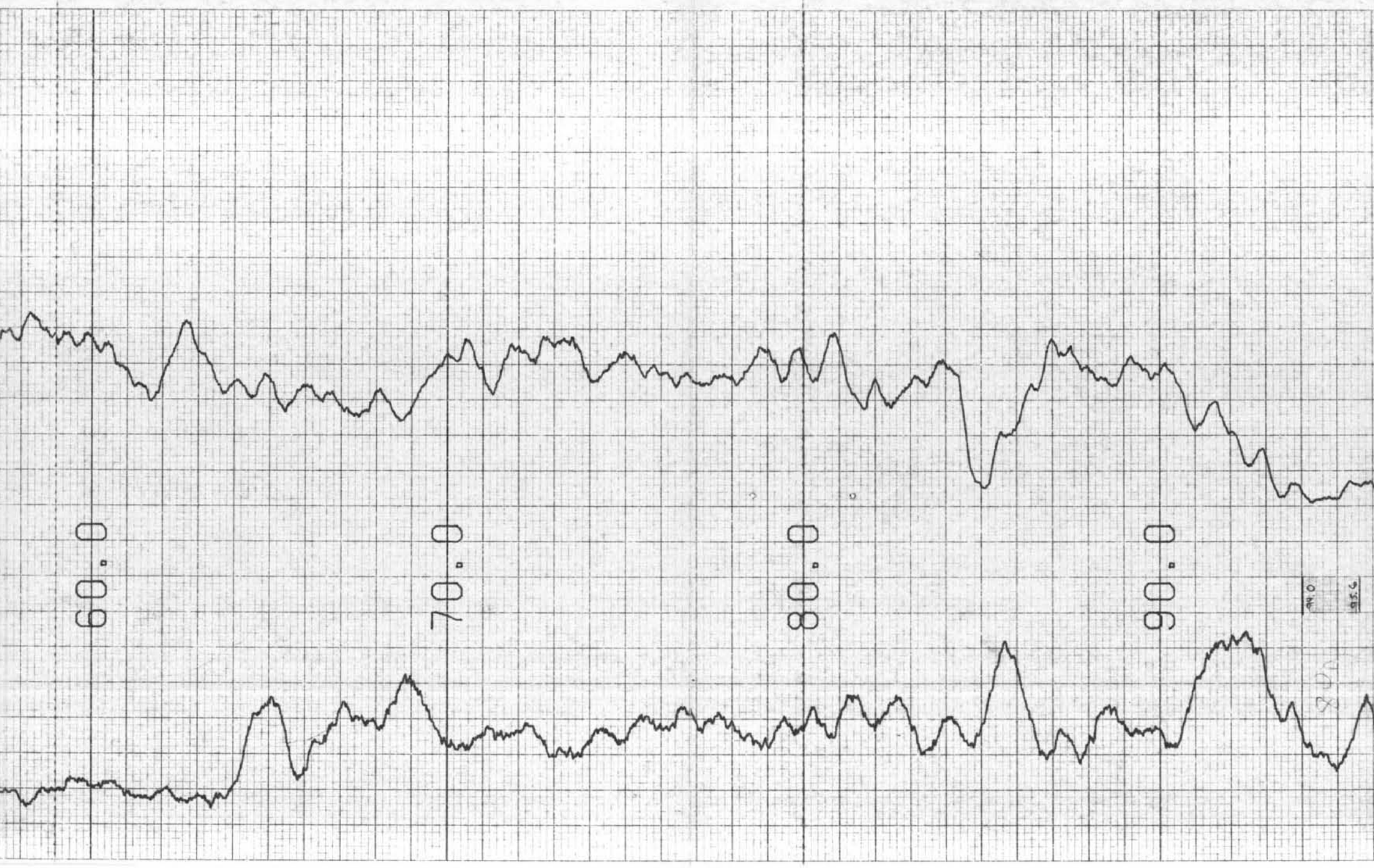
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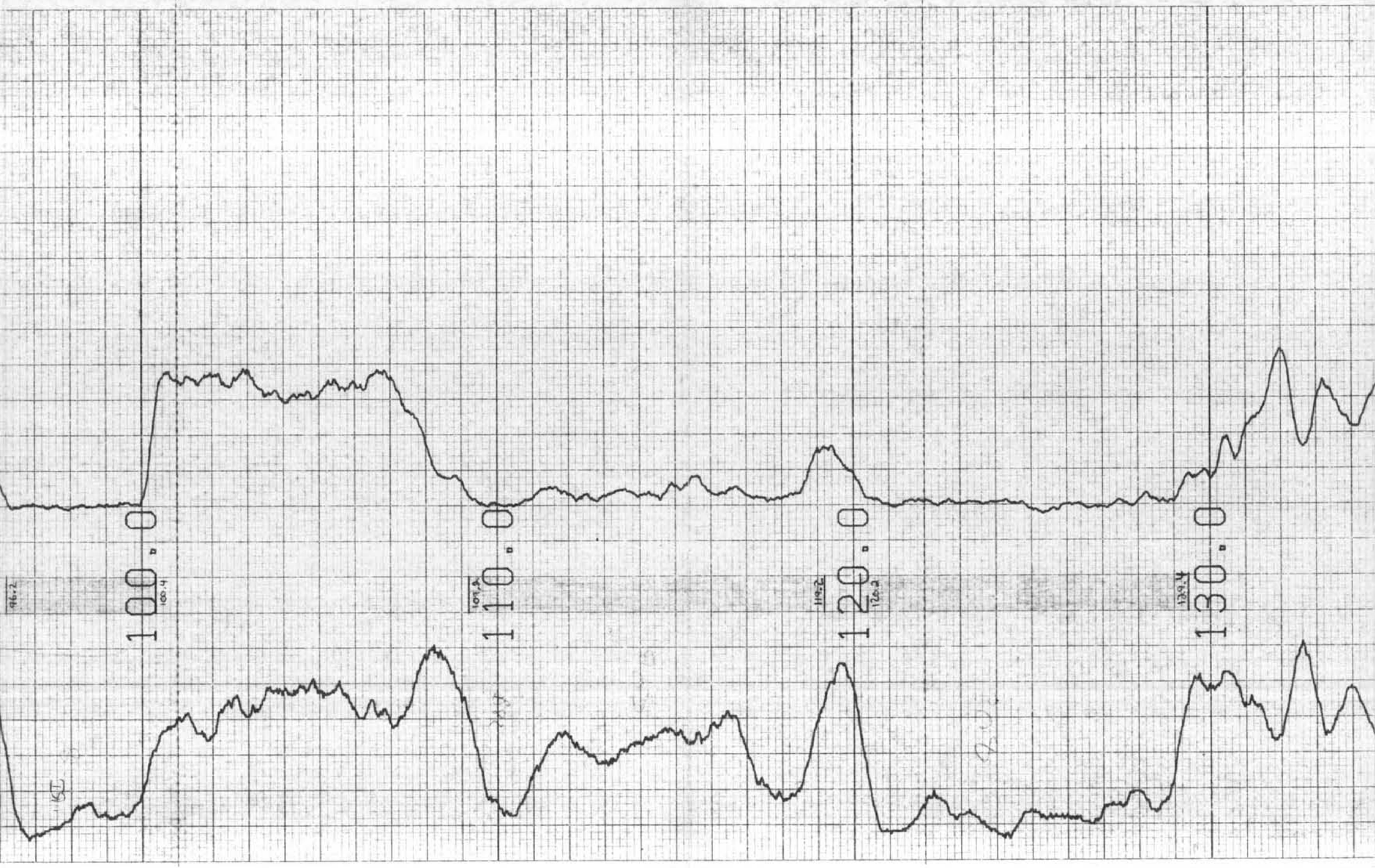
90.0
24.0
95.6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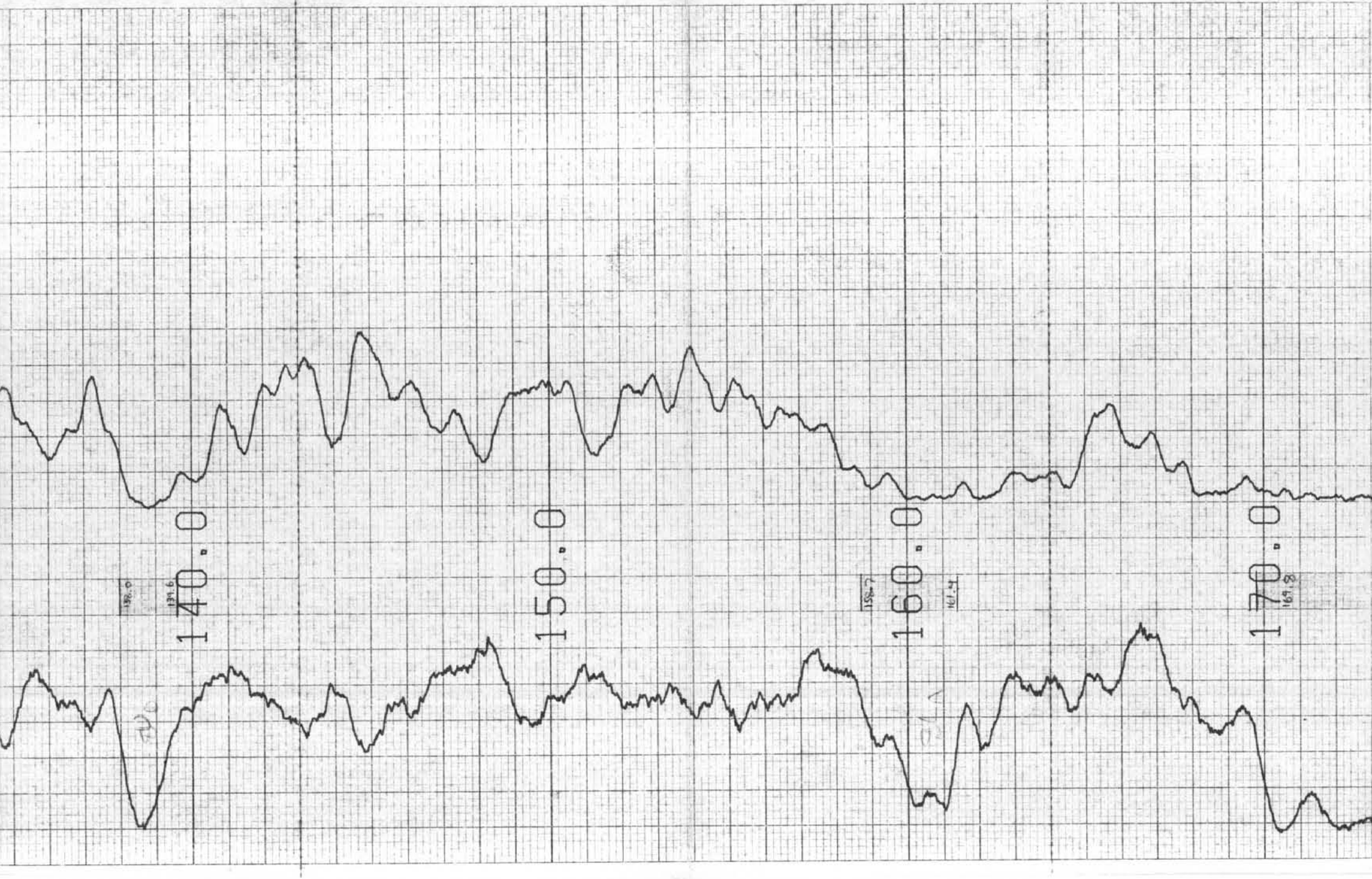
100.4
96.2
110.0
109.8
120.0
126.2
119.2
130.0
139.4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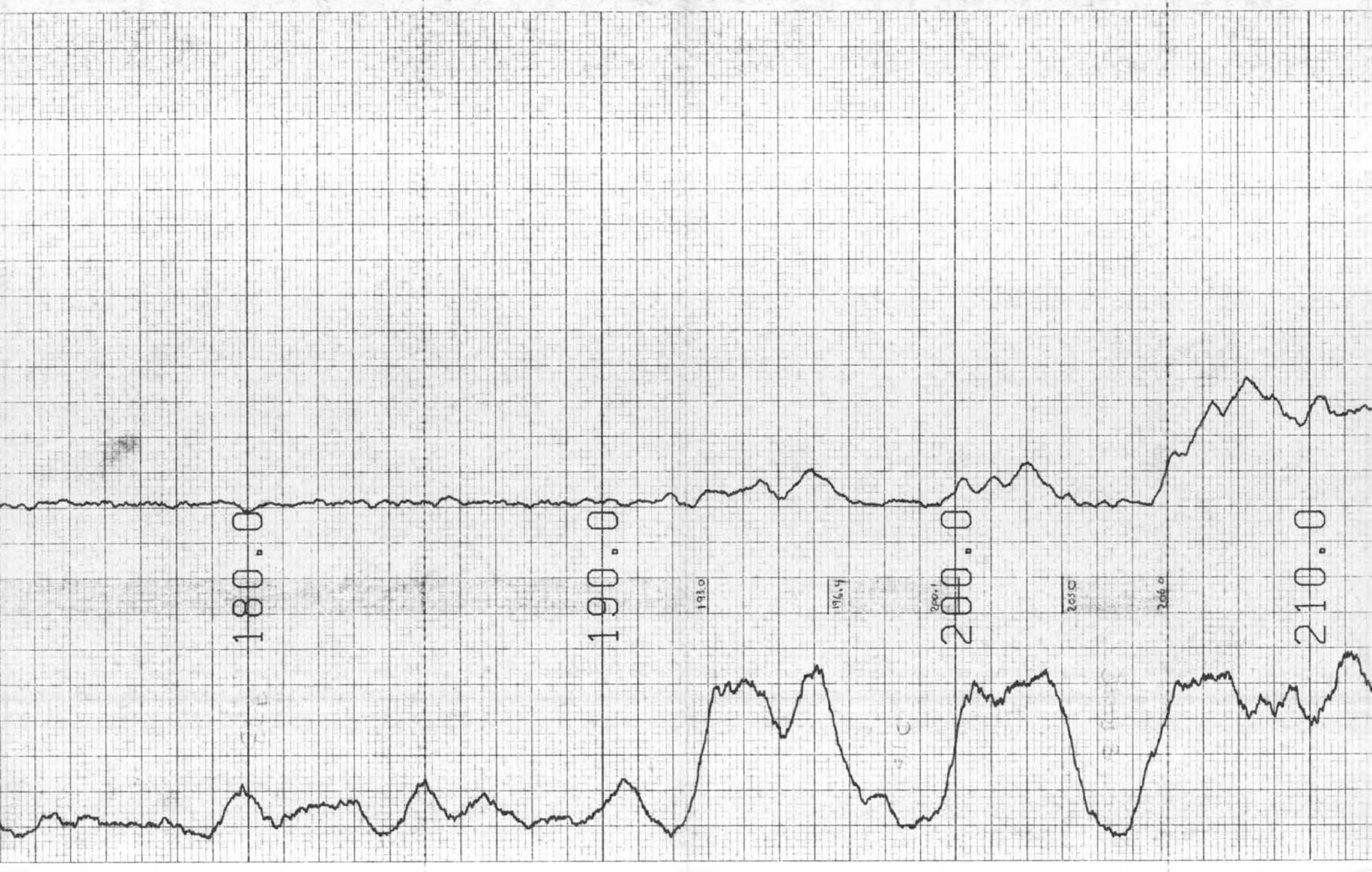
150.0
160.0
170.0
139.6
155.7
161.4
169.8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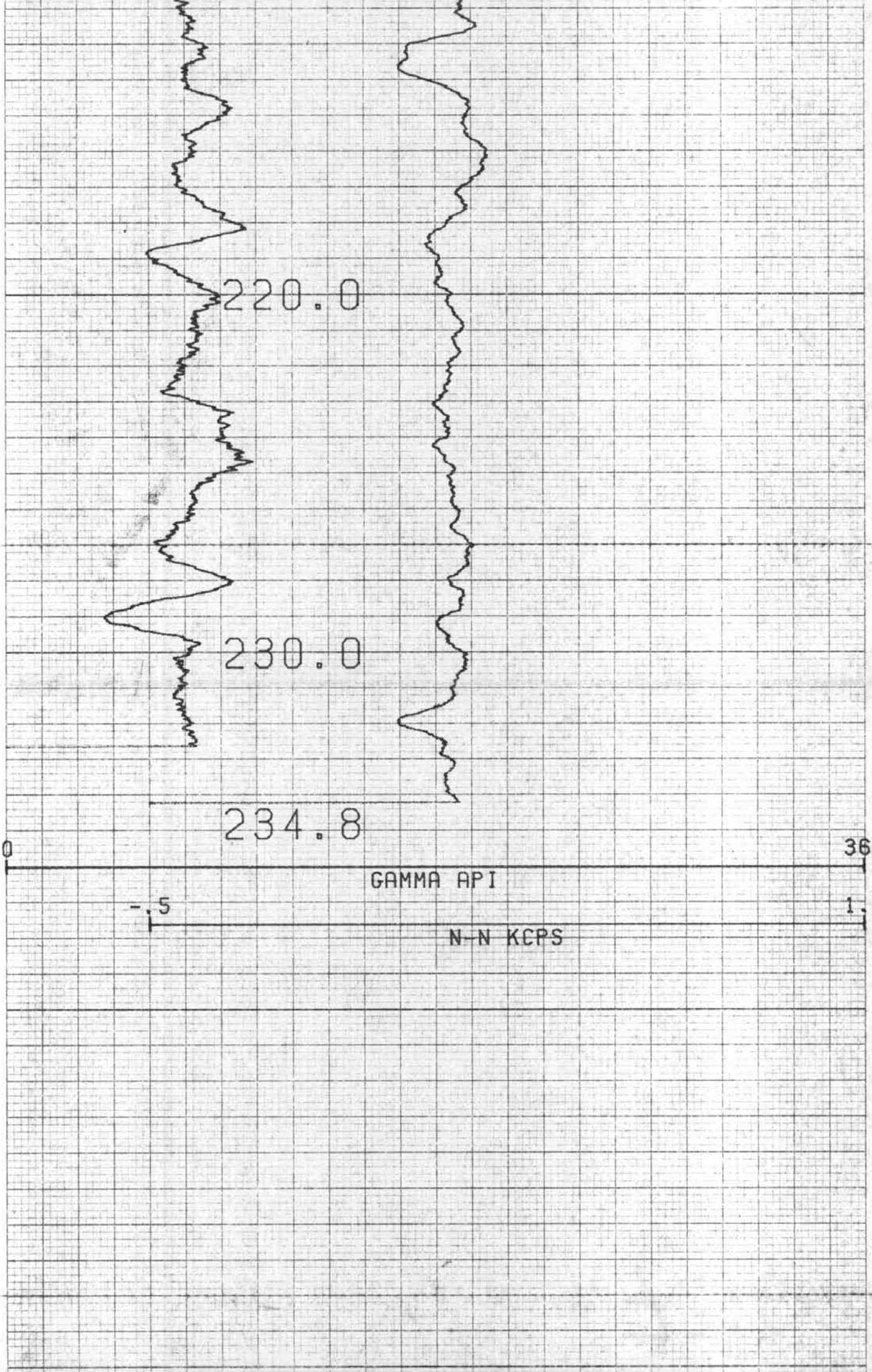


CENTURY GEOPHYSICAL CORP. PART NO. 786-0040

COMPU-LOG V8L2 PLOT 07-09-87

736

R 252

CROWS NEST RESOURCES

HORSESHOE RIDGE BC

HOLE DIAMETER : 13.0

PROBE # 9055A - 048

SENSOR #4 CAL STD CPS = 152

SENSOR #4 CAL RUN CPS = 182

SENSOR #4 CAL BIAS = 0

DATA V8L2*A TRUCK # 7920

D. BOMBACK APPL.#7 L1

Gamma Neutron - Rods

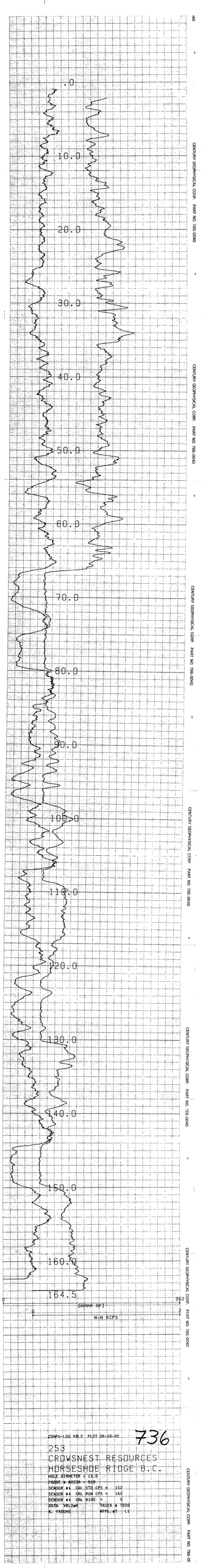
To 234.8

1100 Vert Scale

WATER @ 15 m 75 GPM

-0040

CEI



COMPU-LOG V8.2 PLOT 08-26-87

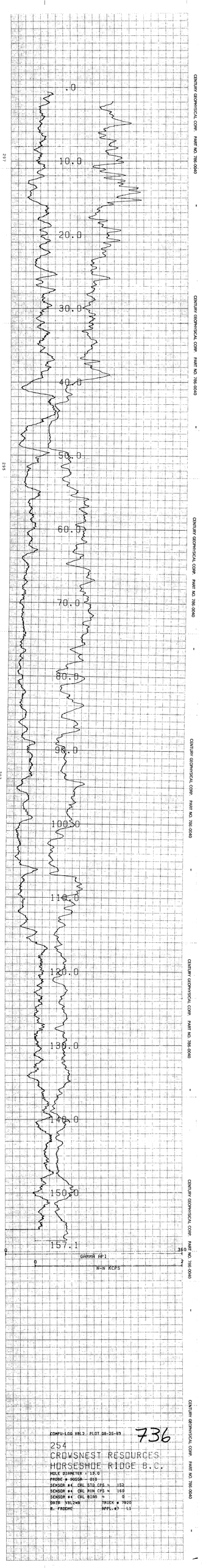
736

253

CROWSNEST RESOURCES

HORSESHOE RIDGE B.C.

HOLE DIAMETER = 13.0
PROBE # 8602A = 010
SENSOR #4 CAL STD CPS = 152
SENSOR #4 CAL RUN CPS = 160
SENSOR #4 CAL BIAS = 0
DATA VOL:#8 TRUCK # 7020
R. FROOME APPL.:#7 L1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50.0
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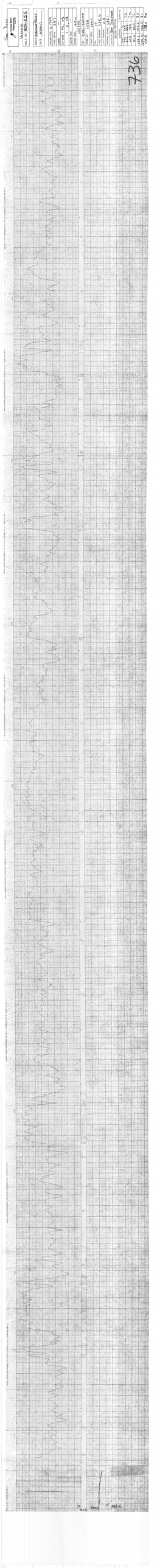
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
157.1
0
360
GAMMA API
0
N=N KCPS
COMPU-LOG VOL2 PLOT 08-26-87
736
254
CROWSNEST RESOURCES
HORSESHOE RIDGE B.C.
HOLE DIAMETER = 15.0
PROBE # 9055R - 010
SENSOR #4 CAL STD CPS = 152
SENSOR #4 CAL BKM CPS = 163
SENSOR #4 CAL BIAS = 0
DATA V8L2#R TRUCK # 7920
R. FROEHE APPL.#? - (.)



736

COMPU-LOG V84.2 PLOT 88-04-01

HSR-255
CROWS NEST RESOURCES
HORSESHOE RIDGE

HOLE DIAMETER = 12.4
PROBE # 8055B - 010
SENSOR #4 CAL STD CPS = 152
SENSOR #4 CAL RUN CPS = 160
SENSOR #4 CAL BIAS = 0
DATA V8L2WR TRUCK # 7820
D. MATAS APPL.#? L1

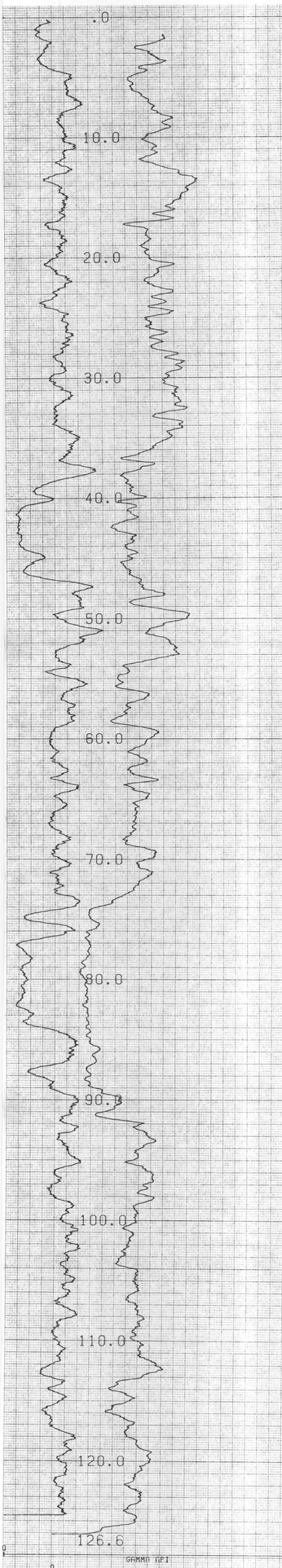
CENTURY GEOPHYSICAL CORP. PART NO. 786-0040

0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
169.5

GAMMA API
0 350
N-N KCPS
-.5 1.5

736

Wet static
10:00
70 - 110 cm H2O



COMPU-LOG VOL 2 PLOT 08-27-87

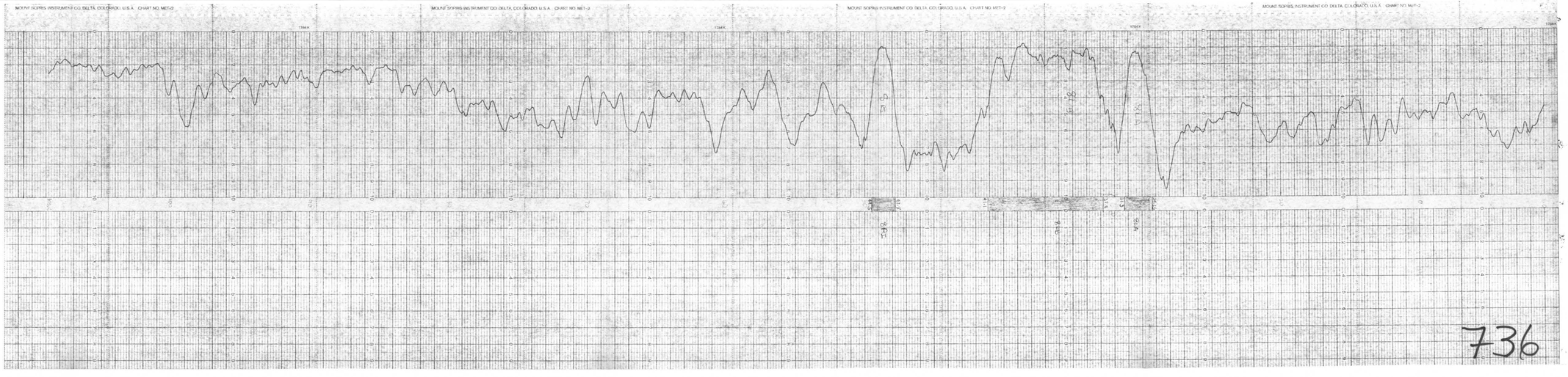
736

257

CROWSNEST RESOURCES

HORSESHOE RIDGE B.C.

HOLE DIAMETER = 13.0
PROBE # 9055A - 010
SENSOR #4 CAL STD CPS = 152
SENSOR #4 CAL RUN CPS = 160
SENSOR #4 CAL BIAS = 0
DATA V8L2#A TRUCK # 7820
R. FRODME APPL.#7 L1



THRU-RODS

Crows Nest Resources LIMITED

VERTICAL

HOLE NO. HSR-258

AREA Horseshoe Ridge

DATE 870909

GROUND LEVEL	1725
TOTAL DEPTH	109.0
CASING	—
BIT SIZES 1	5 5/8"
2	4 7/8"
CASING SIZE	—
WATER LEVEL	52 m

LOG TYPE

LOG	CORL-GAMMA
PROBE NO.	102.6
CHART RATIO	100:1
CPS	10
FIRST READING	108.8
LAST READING	1.0
INTERVAL LOGGED	107.8
ENGINEER	JAN BANNOCK

SEAM DEPTHS

DEPTHS FROM	DEPTHS TO	SEAM NO.
29.3	31.3	8LA
32.8	41.1	8LB
41.8	49.5	8R

Vaccaro
Consultant
Petroleum

Trial Run 2
Well No. Hoe 55-1
Well Description Name
97 mi
Location Data
Operator Name
Hoe Oil Co.
Date 5-5-
Time On 5:4
Time Off 10
Elapsed Time 5:4
Meter Run Size
Orifice Size
Meter Type
Line Pressure
Differential
Temperature
Gravity
Liquid Hydrocarbons
Type Fluid
Gravity
Amount
Water
Type Fluid
Amount
Remarks

	Static	Differential	Temperature
10 A.M.	12.0	6.5	94.5
11 A.M.	11.5	6.3	96

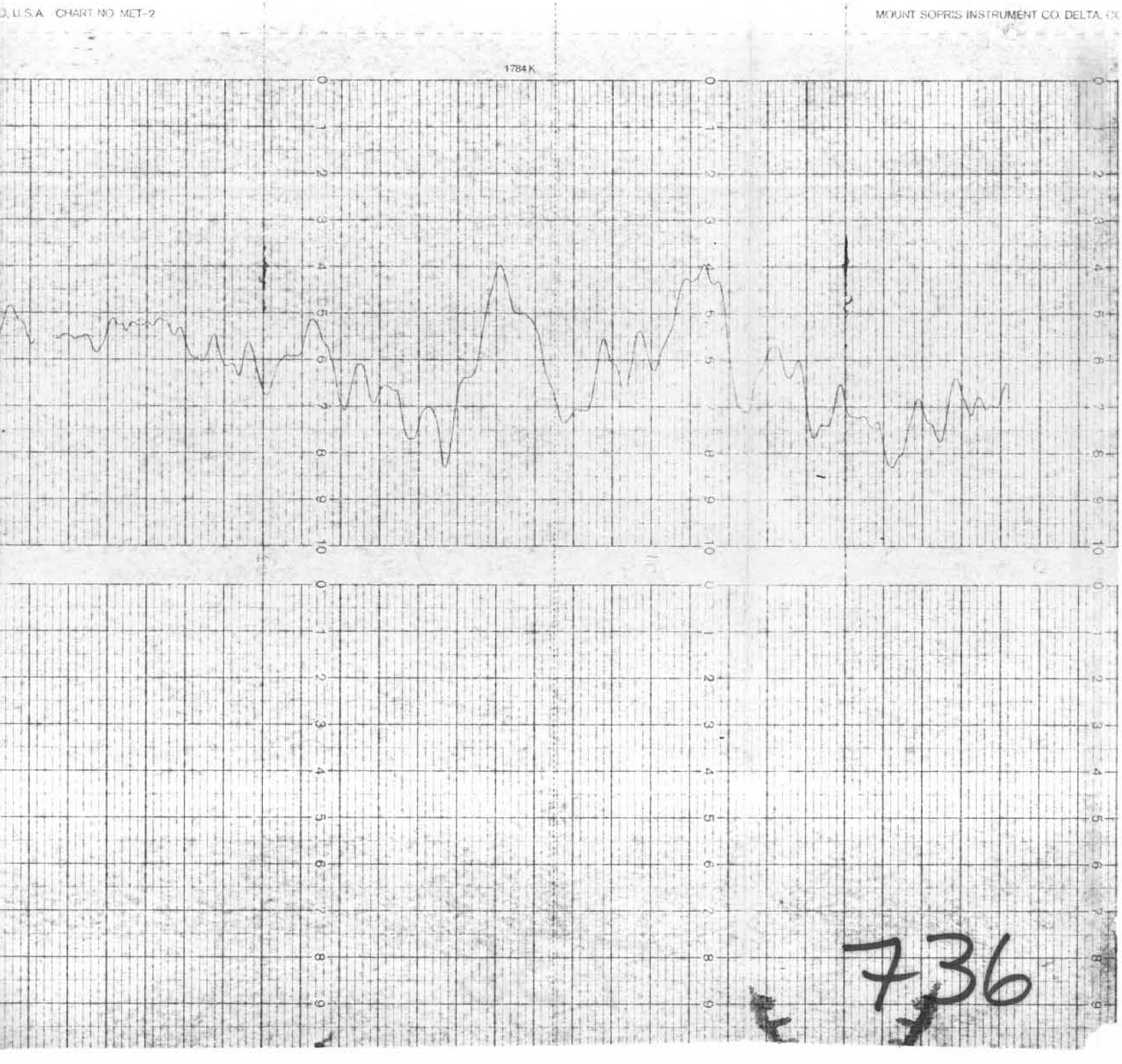
MOUNTAINSIDE INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2

MOUNTAINSIDE INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2

MOUNTAINSIDE INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2

736

WINTER
SPRING
SUMMER
FALL
WINTER
HSE 240
TD 1569
10 APR



THRU - RODS

Crows Nest Resources LIMITED

ANGLE 090/50°

HOLE NO. HSR-261

AREA HORSESHOE RIDGE

DATE 870915

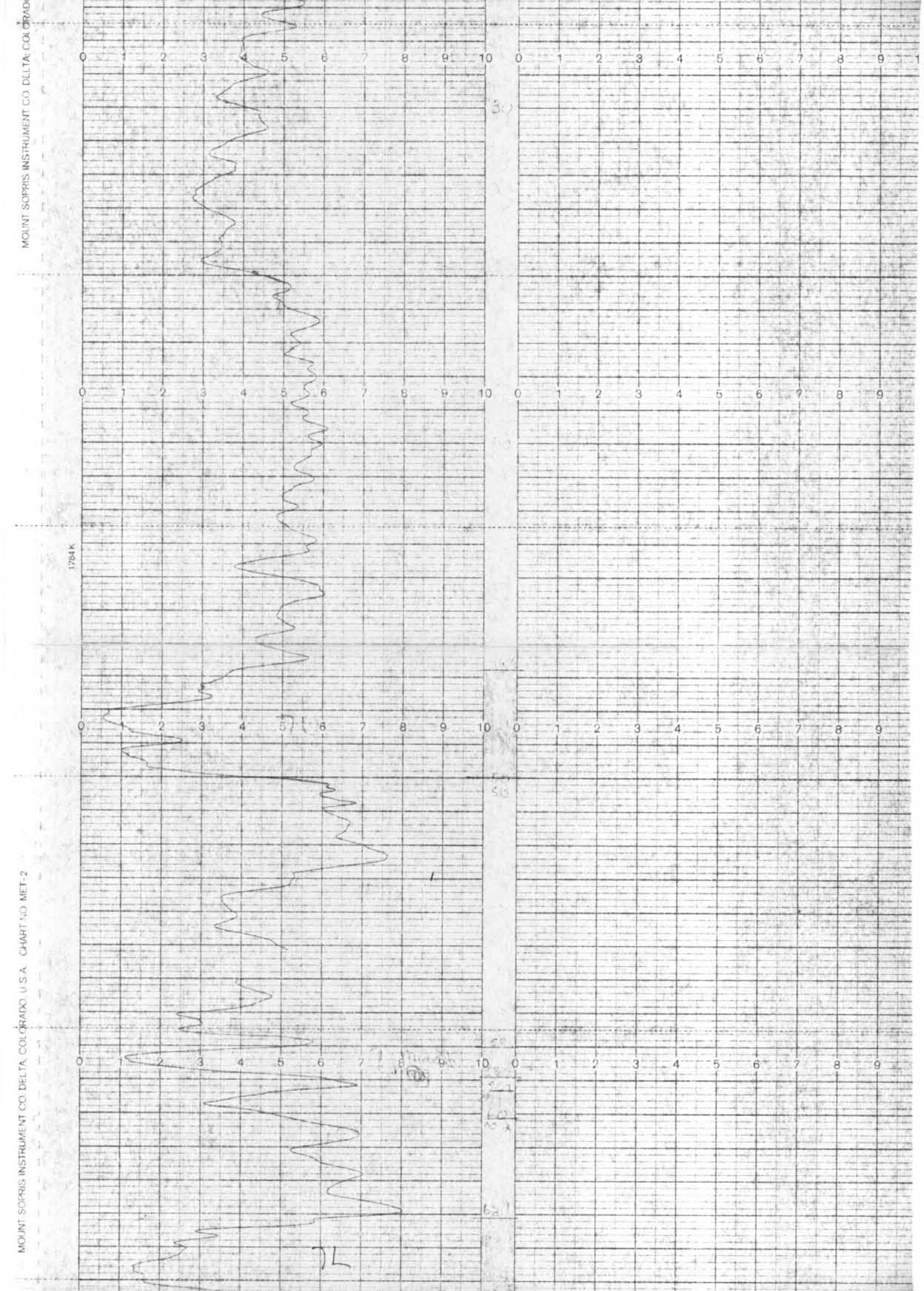
GROUND LEVEL	= 1709
TOTAL DEPTH	200.0
CASING	—
BIT SIZES 1	5¼"
2	5" & 4⅞"
CASING SIZE	—
WATER LEVEL	47. m

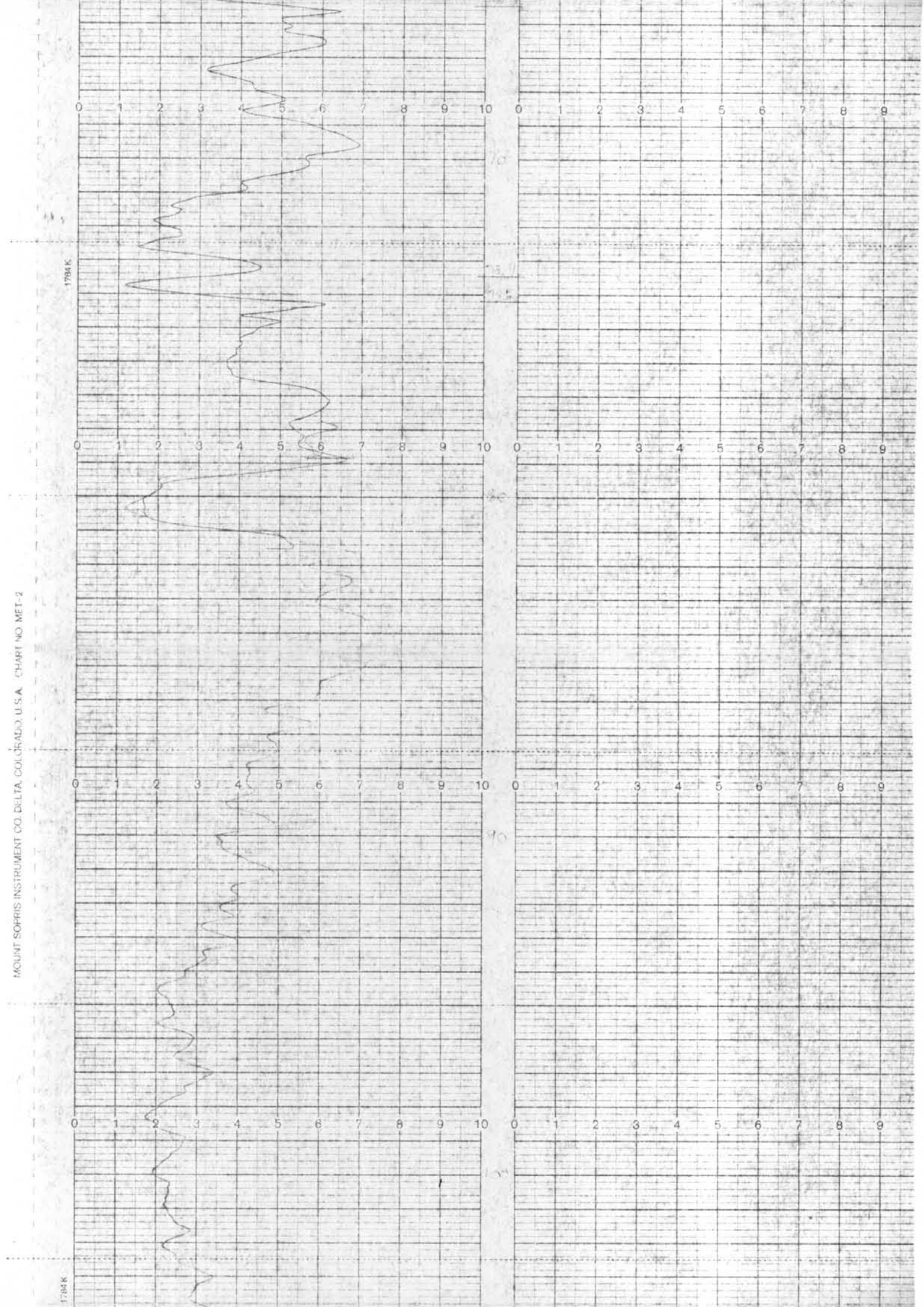
LOG TYPE

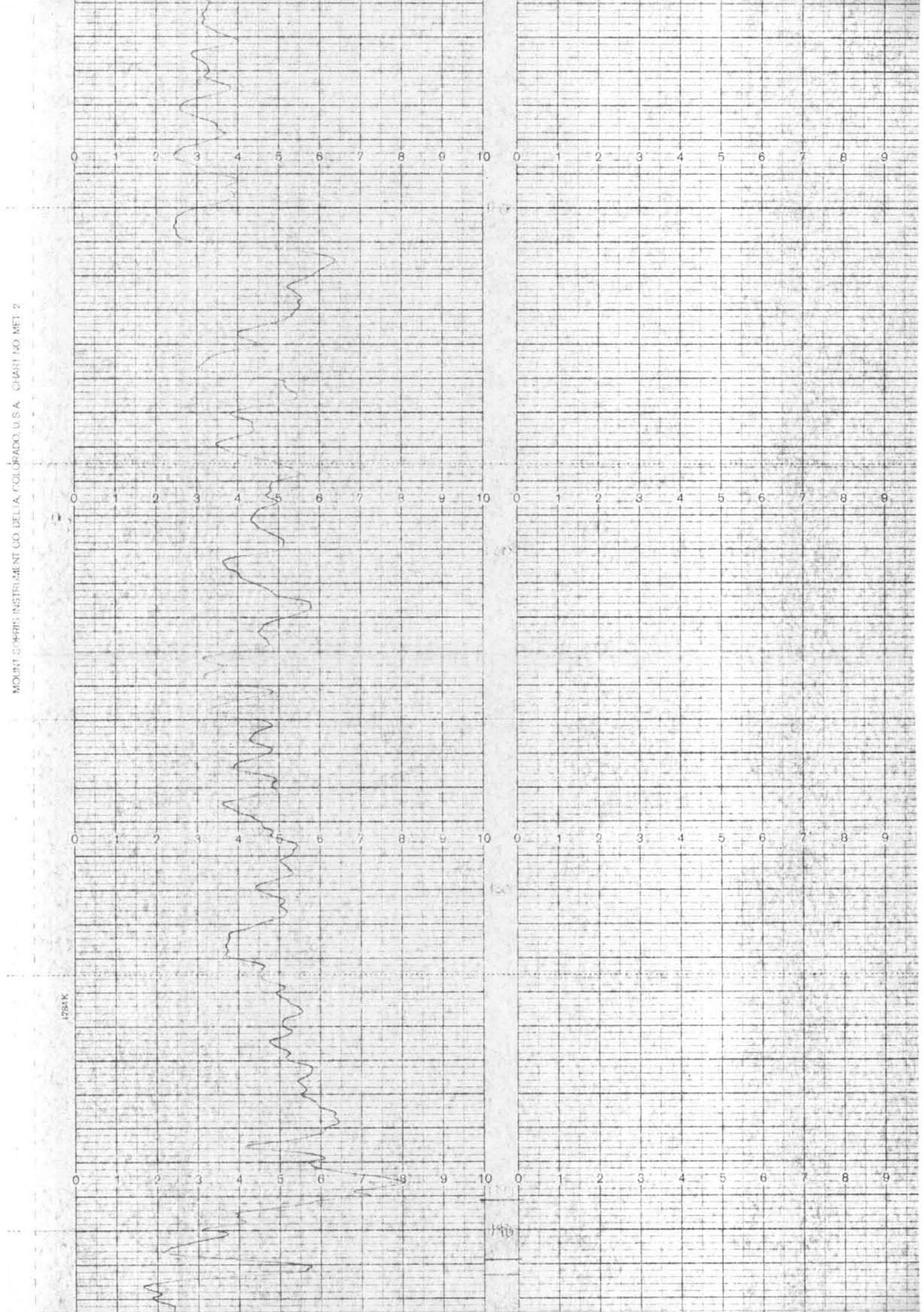
LOG	CNRL- GAMMA
PROBE NO.	1028
CHART RATIO	100:1
CPS	10
FIRST READING	199.8
LAST READING	1.0
INTERVAL LOGGED	198.8
ENGINEER	JAN BANNICK

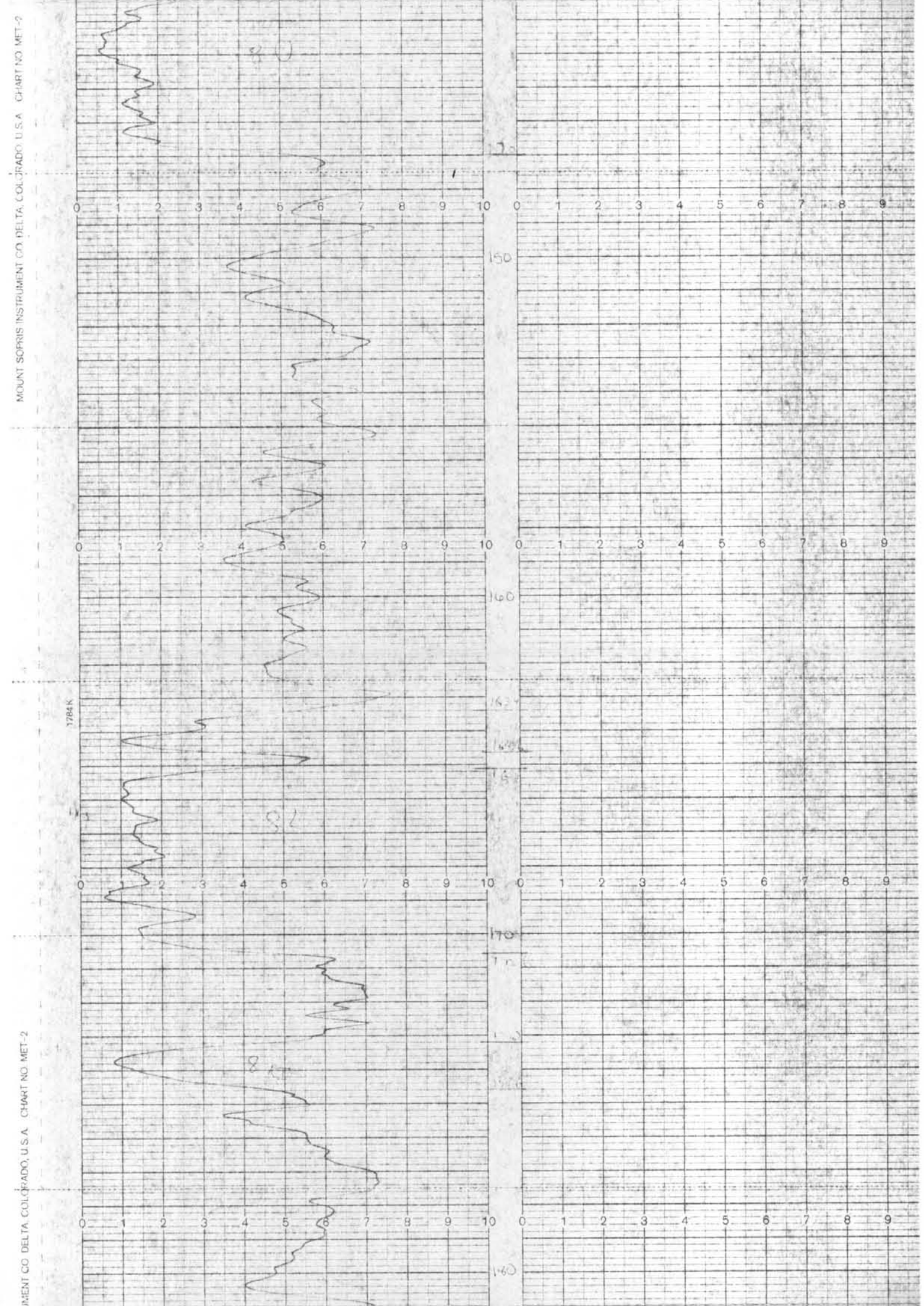
SEAM DEPTHS

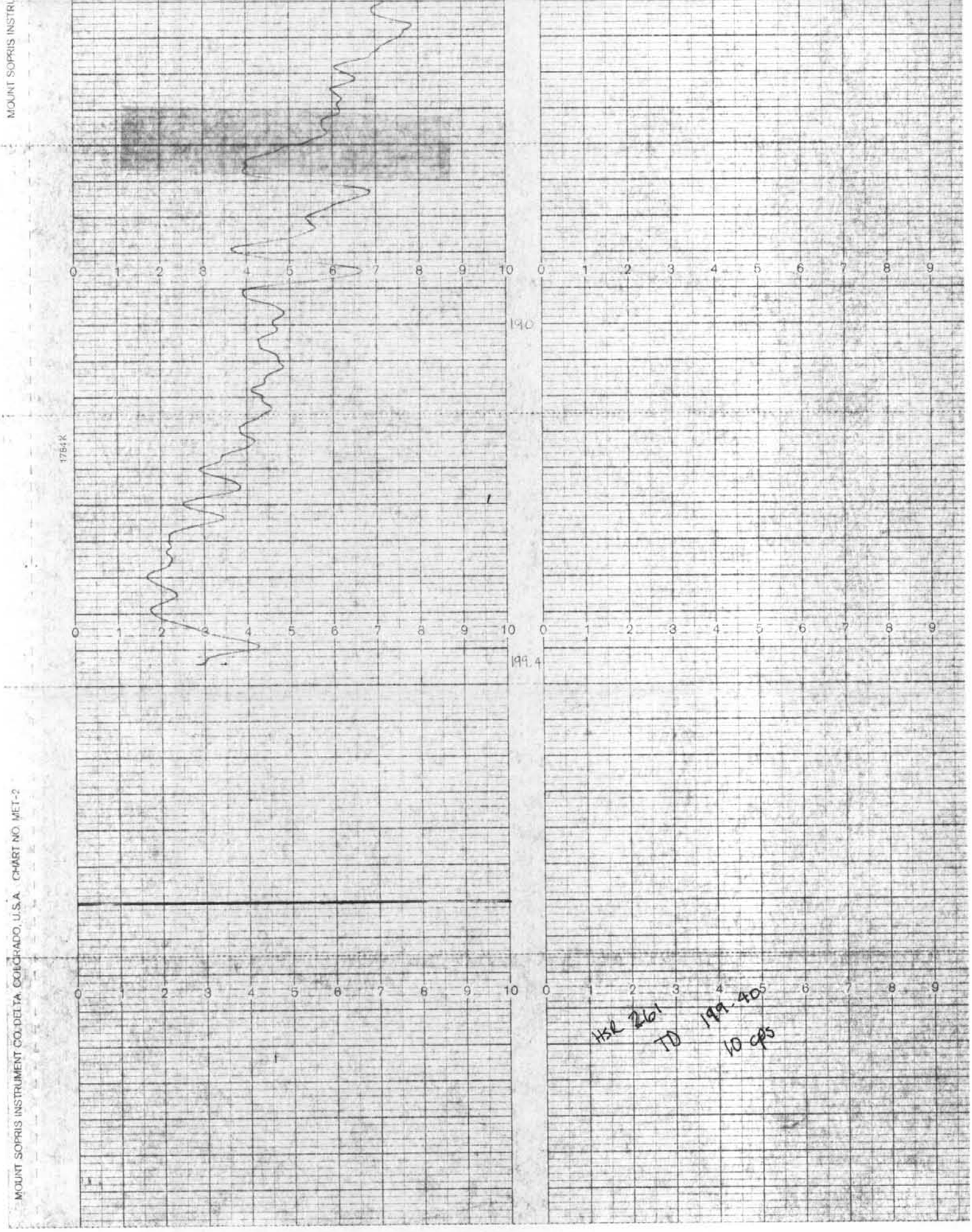
DEPTHS		SEAM NO.
FROM	TO	
46.8	50	7U
58.0	58.9	—
63.1	65.5	7L
73.4	74.2	—
139.1	147.0	8U
163.4	170.6	8L
173.2	174.6	8RI

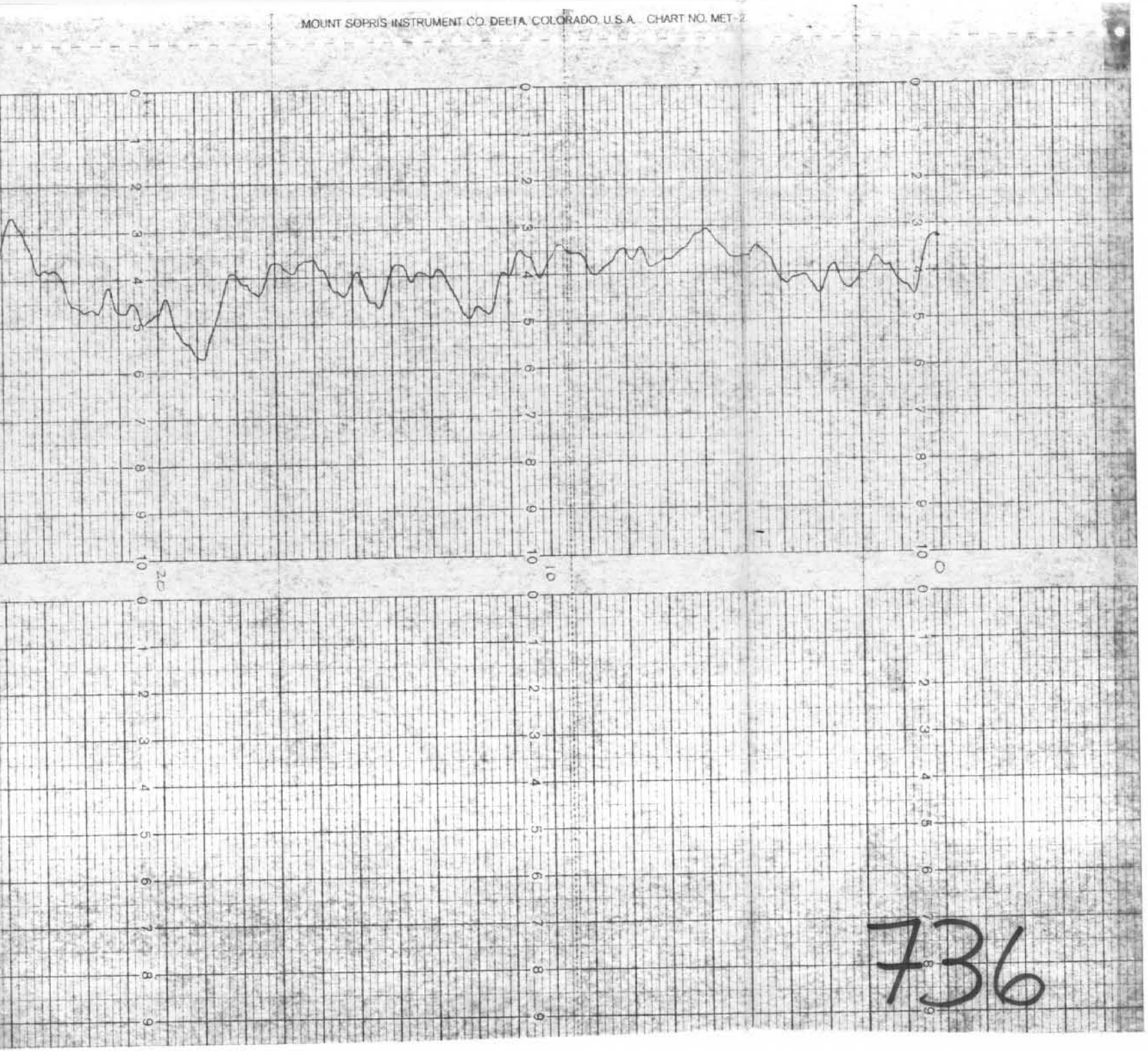

MOUNT SOPRIS INSTRUMENT CO DELTA COLORADO
1784 K
MOUNT SOPRIS INSTRUMENT CO DELTA COLORADO U.S.A. CHART NO MET-2


0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9
1784 K
MOUNT SOFRIS INSTRUMENT CO. DELTA, COLORADO U.S.A. CHART NO. MET-2


MOUNT SOPRIS INSTRUMENT CO DELTA COLORADO U.S.A. CHART NO MET 2
4784K
0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9


MOUNT SOPRIS INSTRUMENT CO DELTA, COLORADO, U.S.A. CHART NO MET-2
1784K
0 1 2 3 4 5 6 7 8 9 10
150
160
170
180


MOUNT SOPRIS INSTRU
0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9
190
1764K
0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9
199.4
0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9
HSL 2601
TD 199.405
10 cps
MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2



THRU-RODS

Crows Nest Resources LIMITED

270/50°

HOLE NO. HSR-262

AREA HORSESHOE RIDGE

DATE 871102

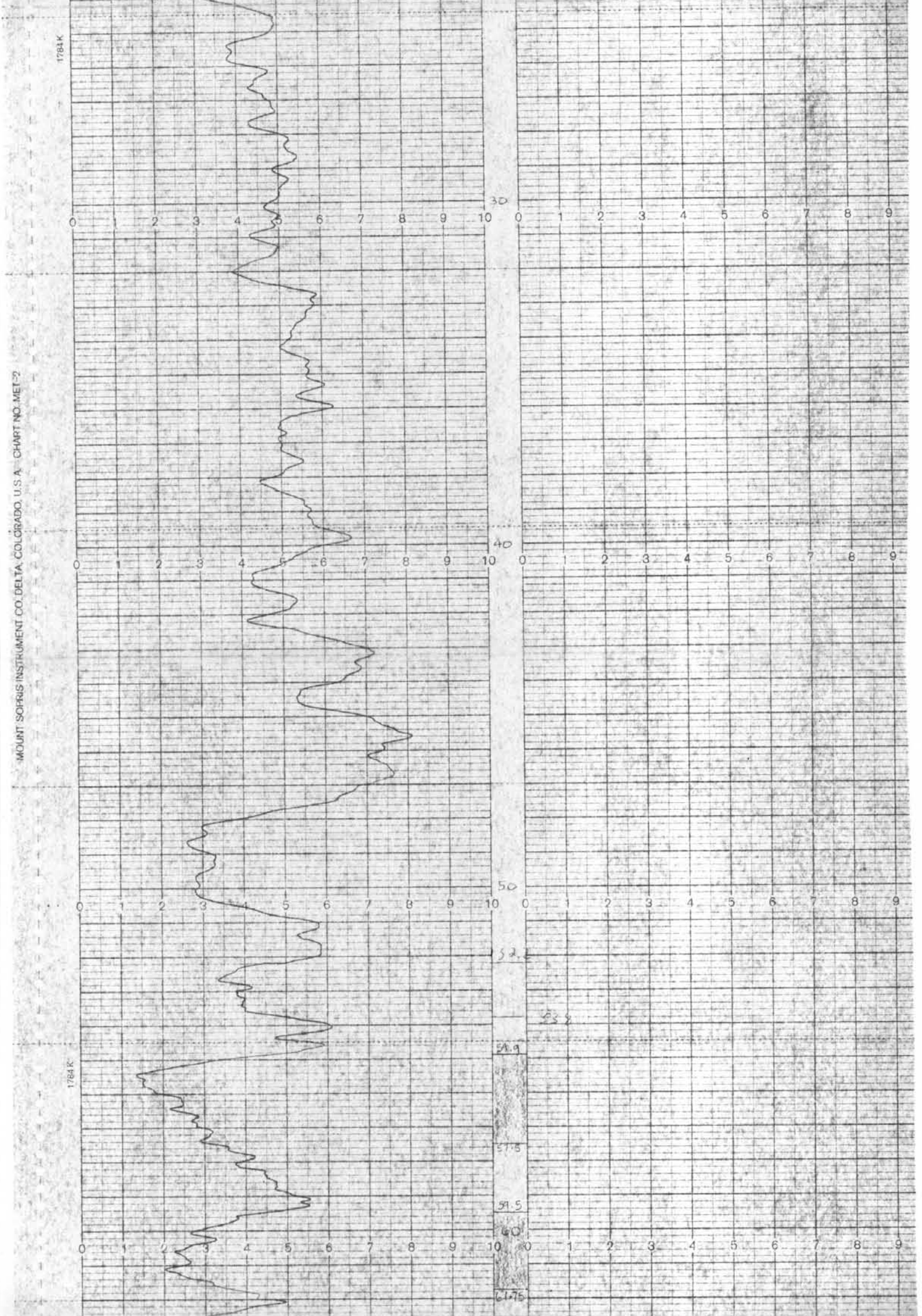
GROUND LEVEL	1657
TOTAL DEPTH	234.2
CASING	—
BIT SIZES 1	5¼
2	5⅛ & 5"
CASING SIZE	—
WATER LEVEL	2.5 m

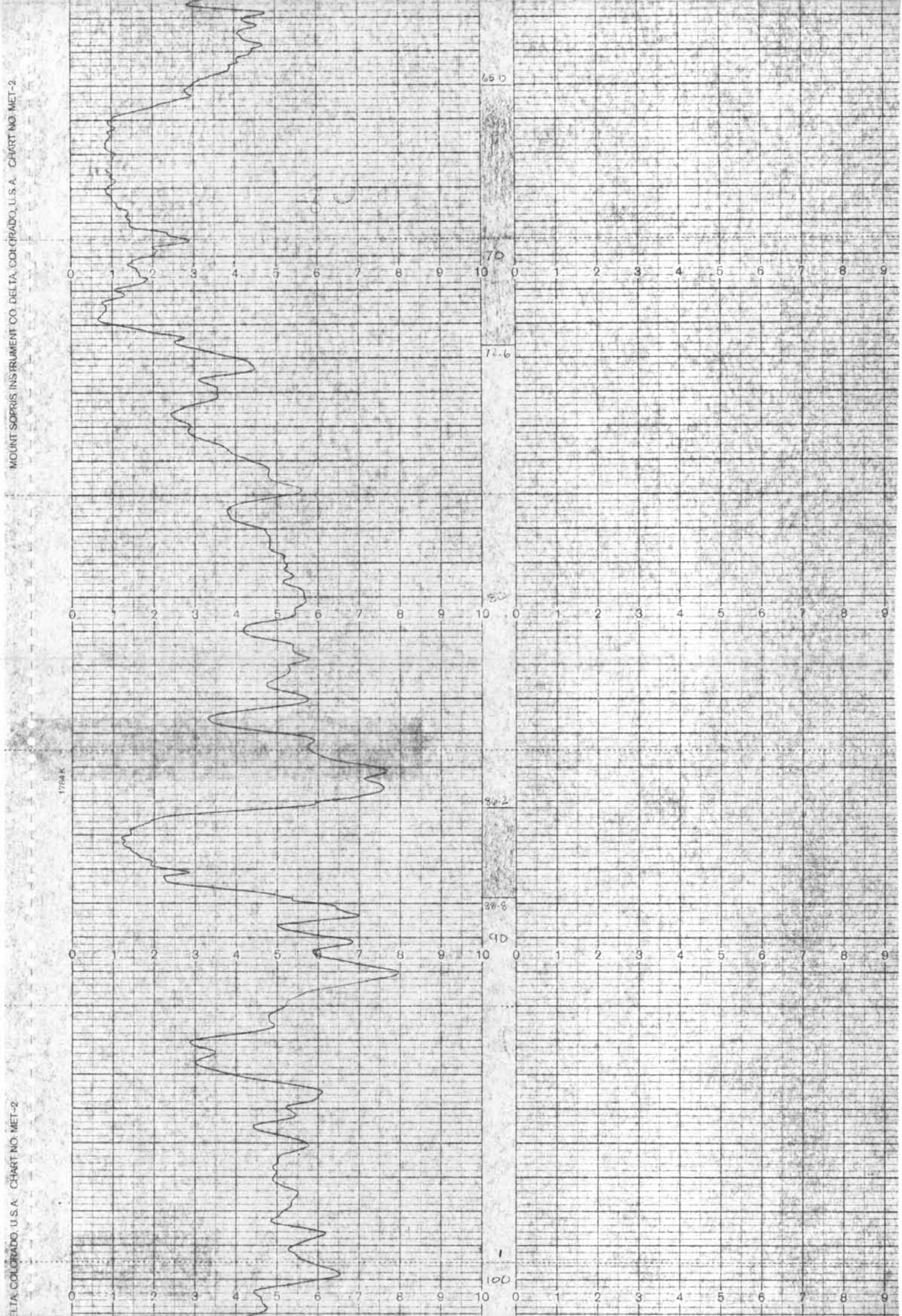
LOG TYPE

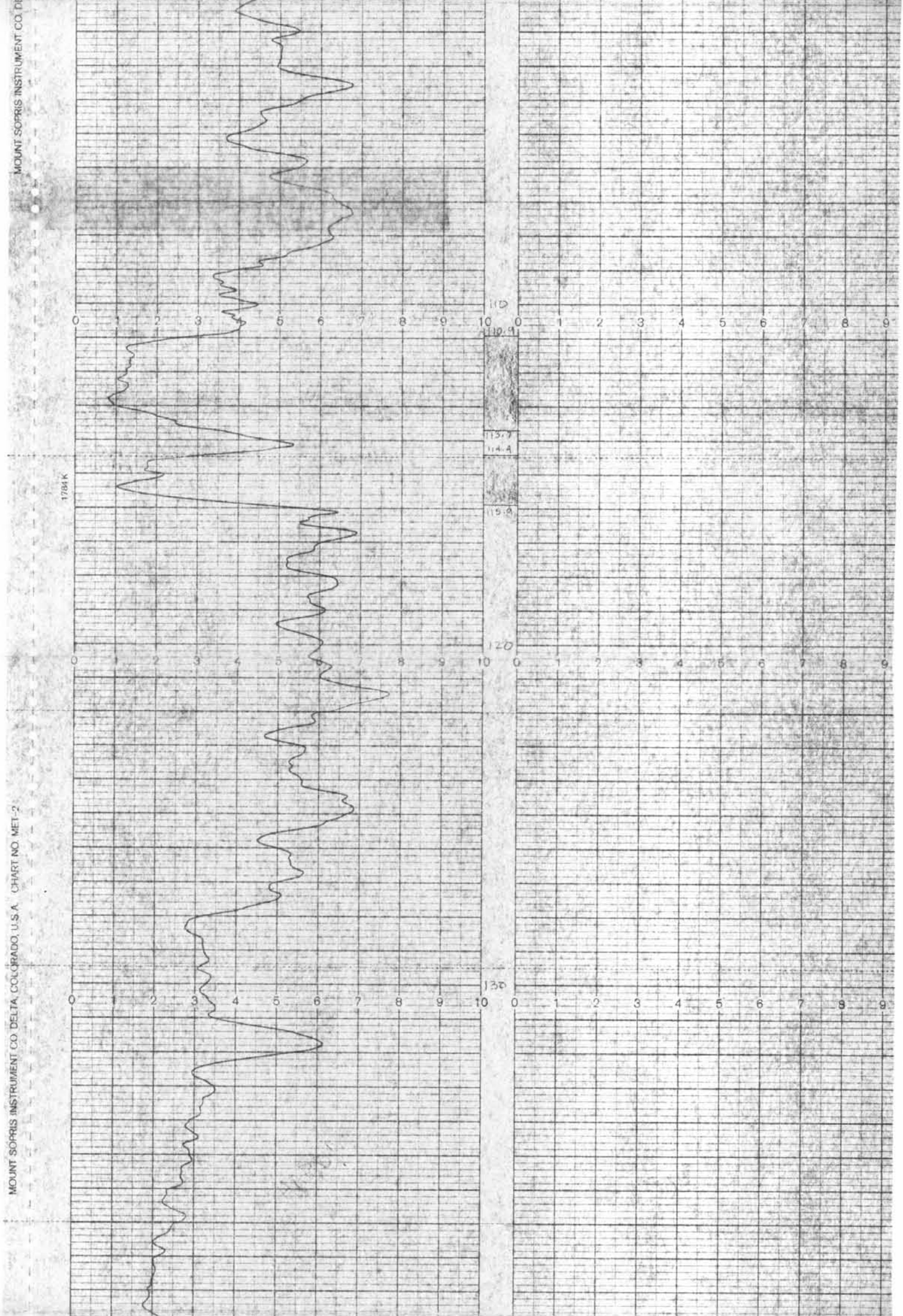
LOG	CNRL- GAMMA
PROBE NO.	1028
CHART RATIO	100:1
CPS	10
FIRST READING	233.2
LAST READING	0
INTERVAL LOGGED	233.2
ENGINEER	JAN BANNICK

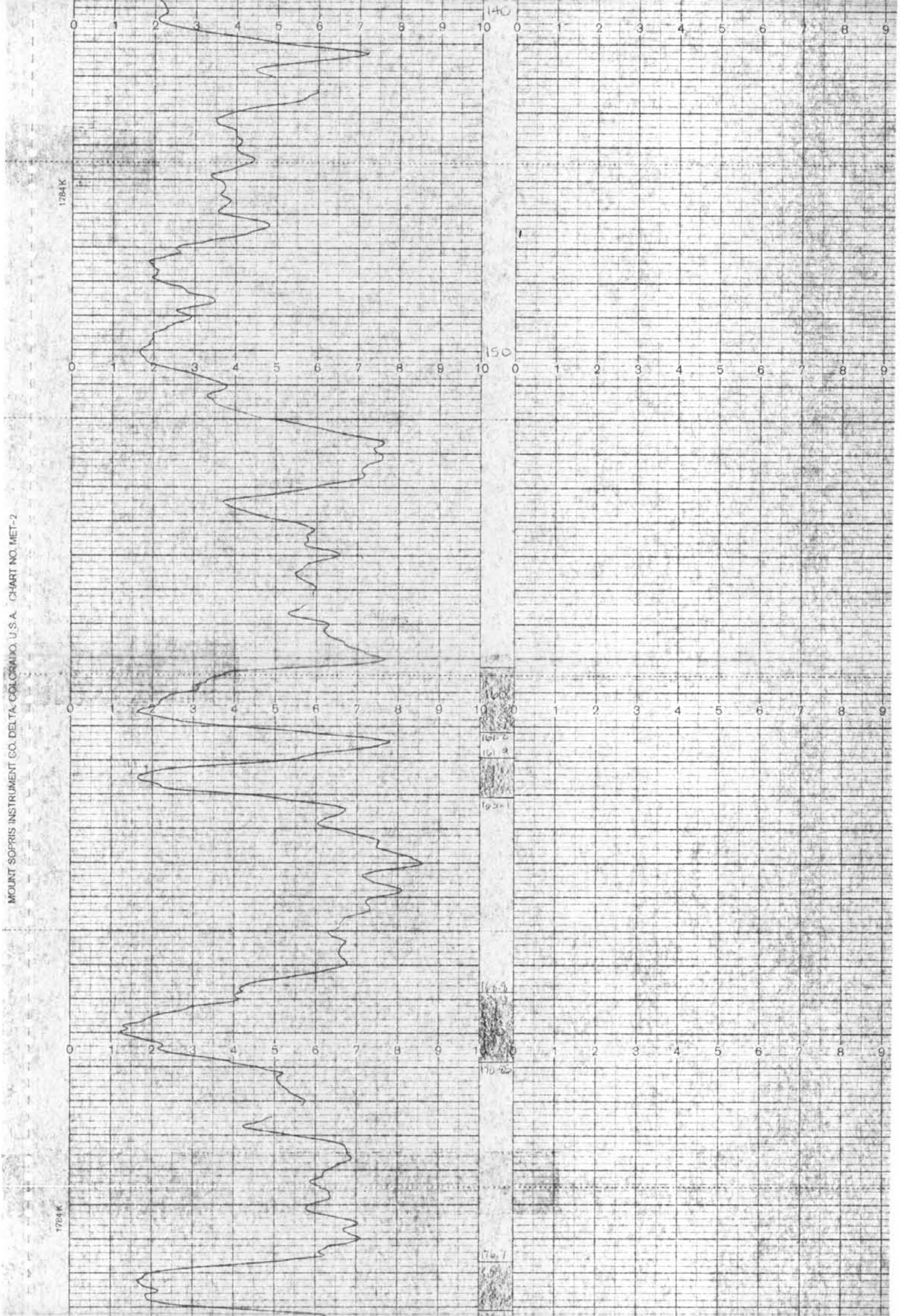
SEAM DEPTHS

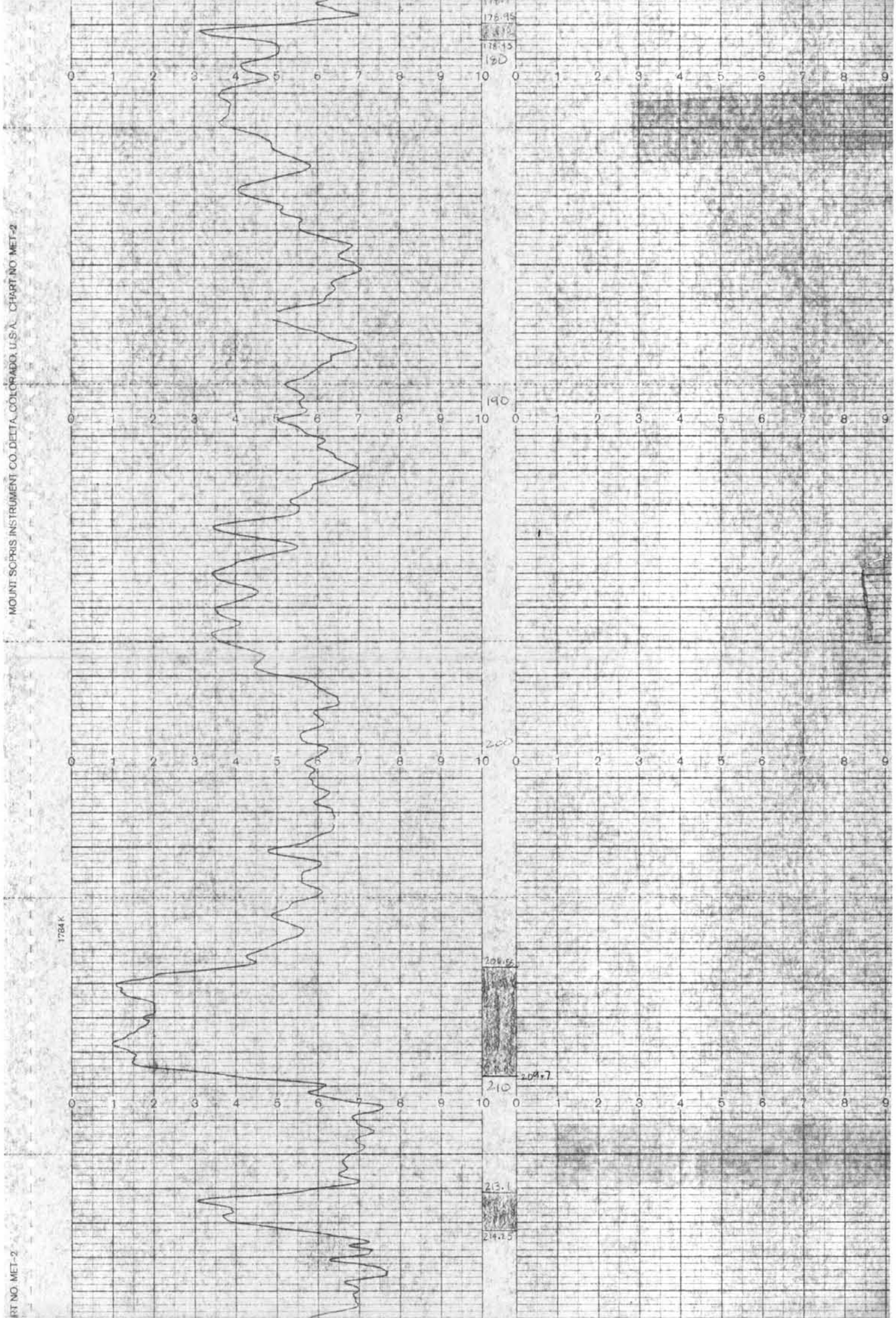
DEPTHS		SEAM NO.
FROM	TO	

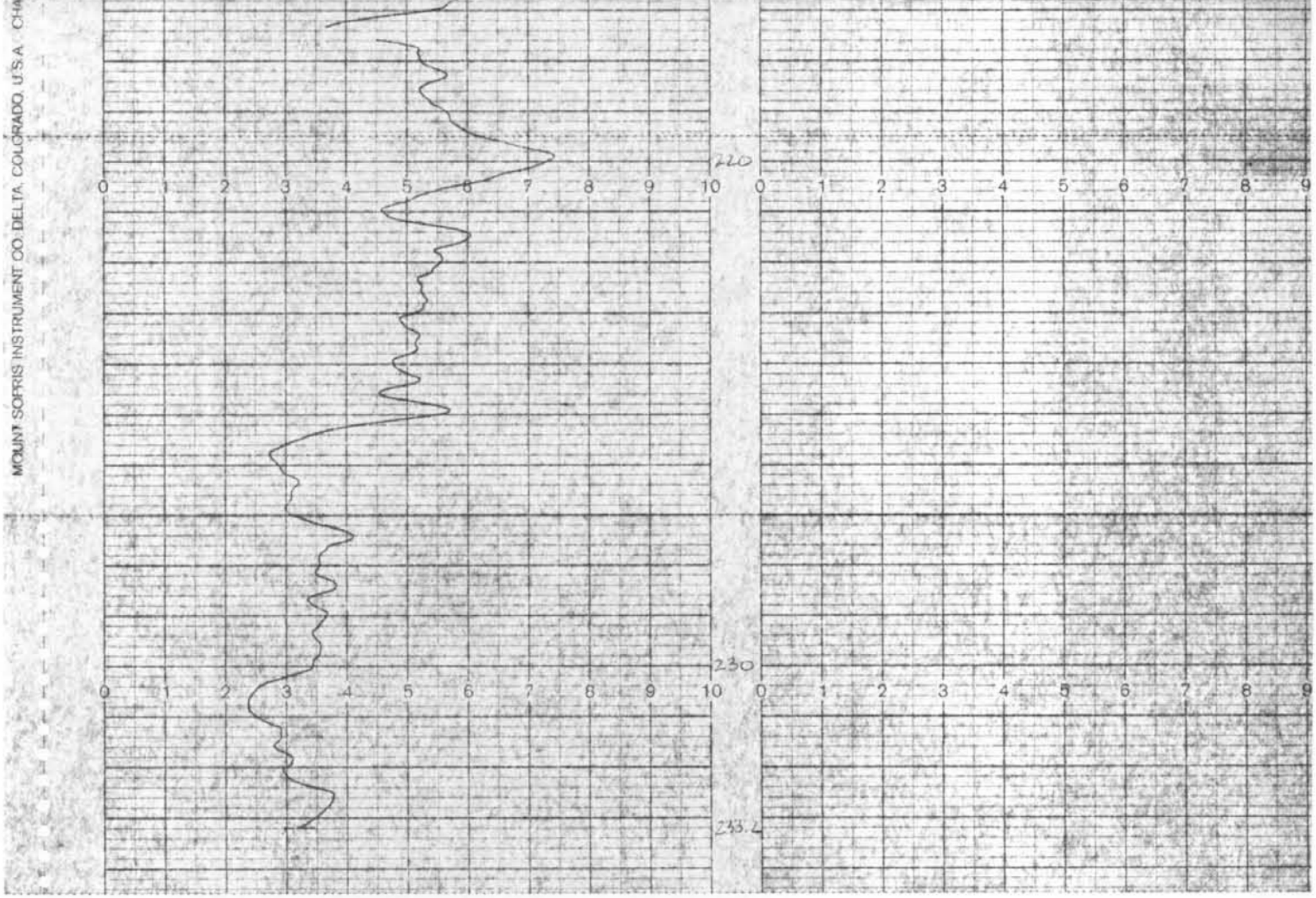

MOUNT SOFRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2
1784 K
30
40
50
52.2
53.2
54.9
57.5
59.5
60
61.75
1784 K

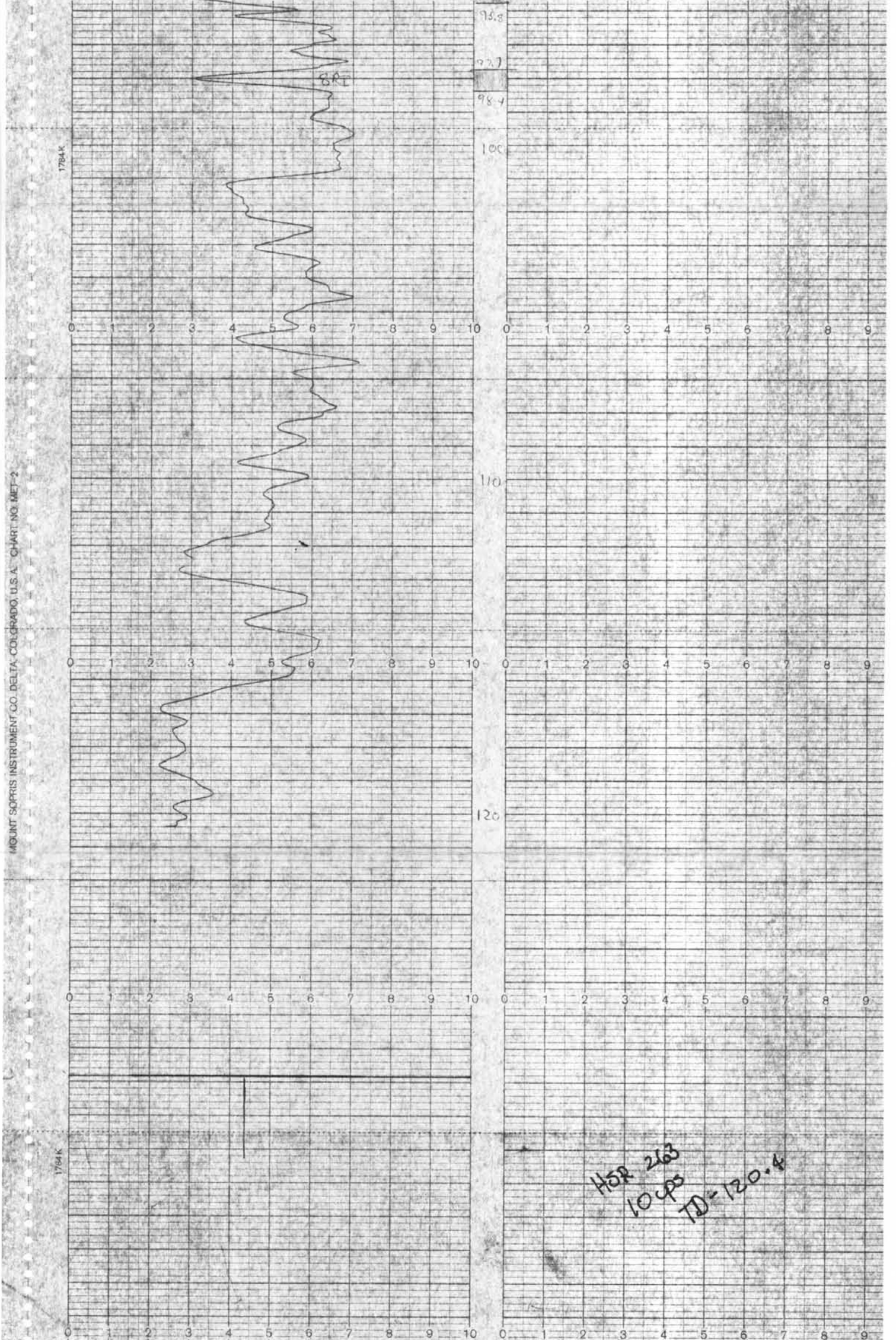

MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2
65.0
70
72.6
80
86.2
88.8
90
100
1764K
DELTA, COLORADO, U.S.A. CHART NO. MET-2

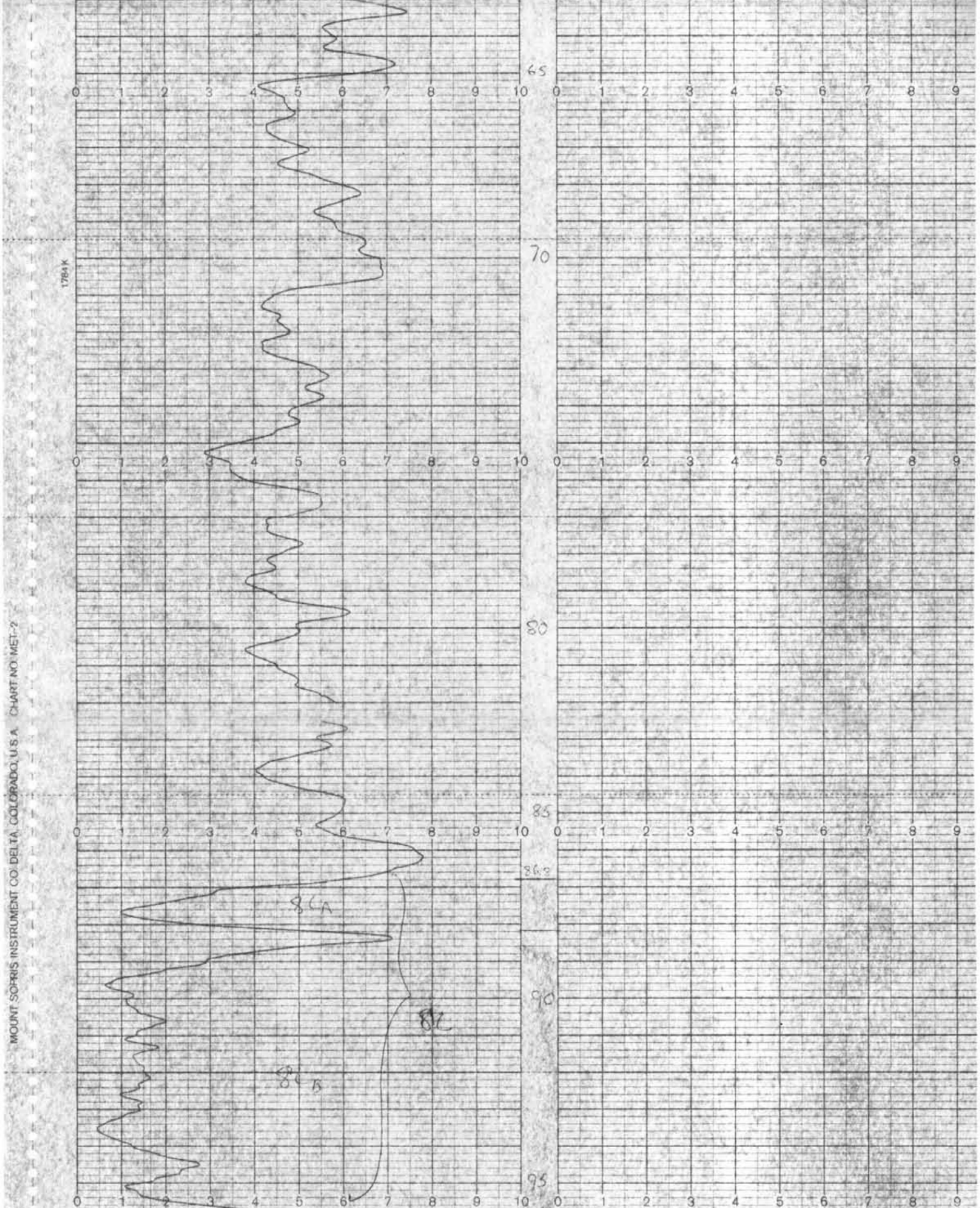

MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2
1784 K
110
110.9
113.7
114.4
115.9
120
130

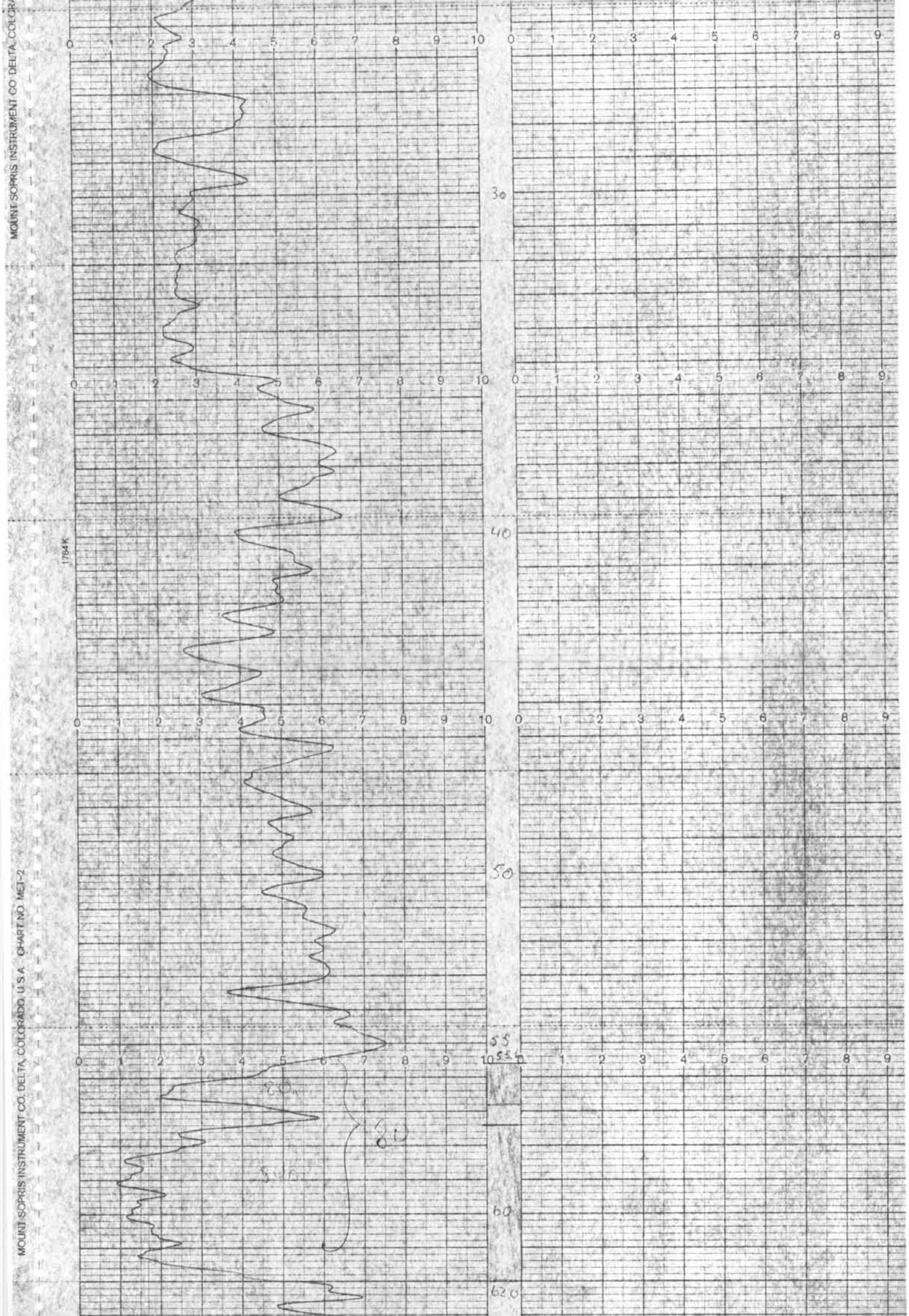

MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2
1784K
140
150
160
161.2
161.9
163.1
164.9
170.82
176.7
1784K

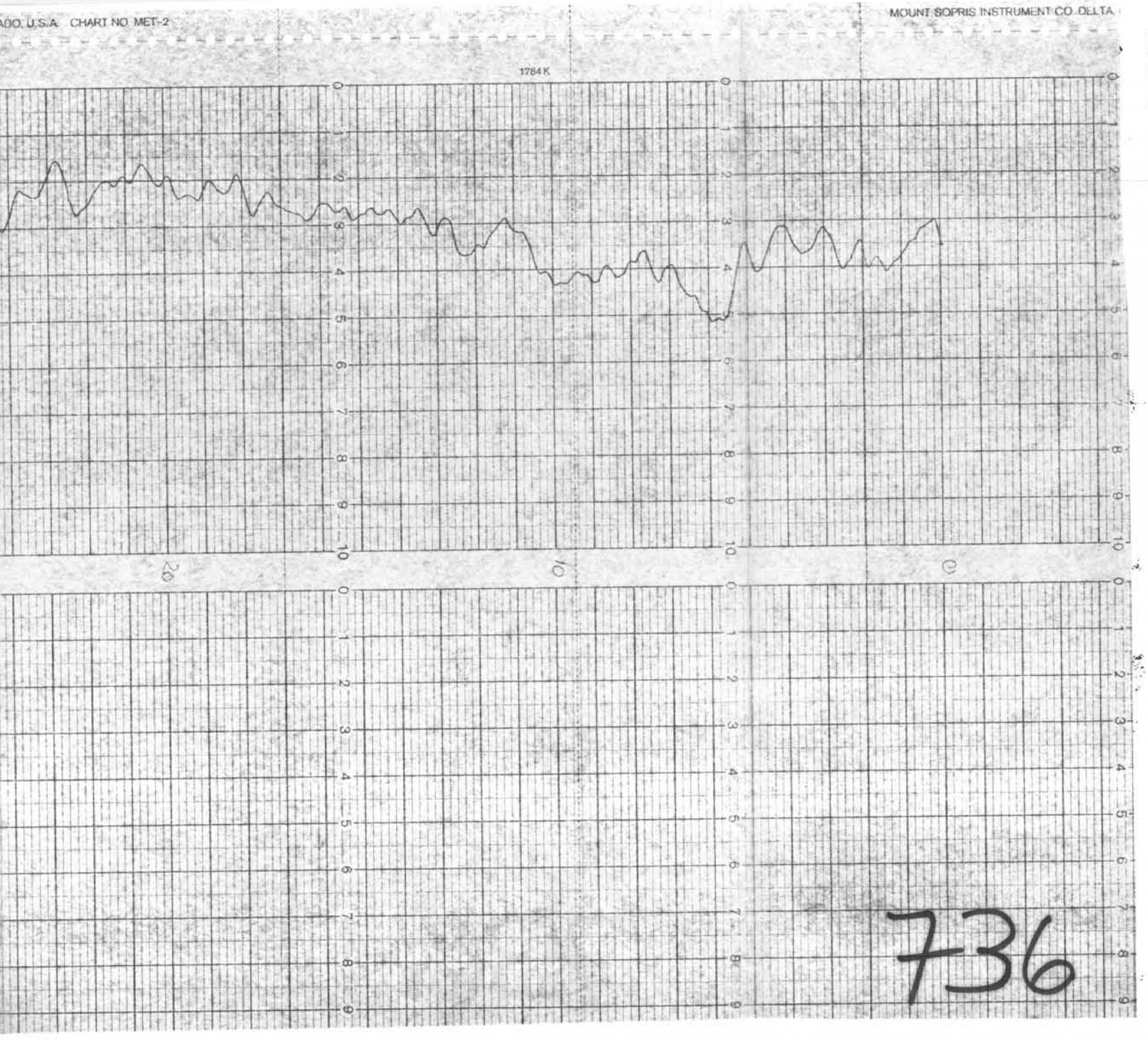

MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2
178.95
178.15
180
190
200
1784 K
208.65
209.7
210
213.1
214.25
MET-2


MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A.
220
230
233.4
0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9


MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2
1784K
95.8
97.7
98.4
100
110
120
8RT
HSR 263
10 cps
TD-120.4


65
70
80
85
86.3
90
95
86A
86B
86C
0 1 2 3 4 5 6 7 8 9 10
1784-K
MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2


MOUNT SOPRIS INSTRUMENT CO. DELTA, COLORADO, U.S.A. CHART NO. MET-2
1784K
30
40
50
55
60
62.0



THRU- ROOS

Crows Nest Resources LIMITED

ANGLE 090/50°

HOLE NO. HSR- 263

AREA HORSESHOE RIDGE

DATE 871027

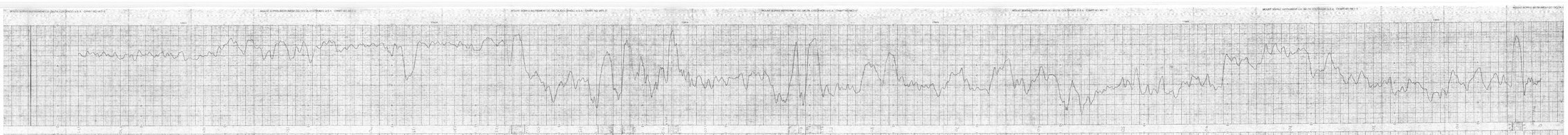
GROUND LEVEL	≈ 1657
TOTAL DEPTH	121
CASING	—
BIT SIZES 1	5 1/8"
2	5"
CASING SIZE	—
WATER LEVEL	50 m

LOG TYPE

LOG	CNRL- GAMMA
PROBE NO.	1028
CHART RATIO	100:1
CPS	10
FIRST READING	120.4
LAST READING	0
INTERVAL LOGGED	120.4
ENGINEER	JAN BANNICK

SEAM DEPTHS

DEPTHS		SEAM NO
FROM	TO	
55.6	62.0	8U
86.8	95.8	8L
97.7	98.4	8RI



Thru - Bore

Crows Nest Resources Limited

Bore # 270550

HOLE NO. WSR- 2.66

AREA Peak Downs Range

DATE 9/11/04

GROUND LEVEL	R 1669
TOTAL DEPTH	346.0
CASING	-
BIT SIZES 1	5¾"
2	5"
CASING SIZE	-
WATER LEVEL	55 m

LOG TYPE

LOG	Coal - Gamma
PROBE NO.	1075
CHART RATIO	1001
CPS	1:0
FIRST READING	175
LAST READING	0
INTERVAL LOGGED	175
ENGINEER	Dan Bennett

SEAM DEPTHS

DEPTHS FROM	DEPTHS TO	SEAM NO
0.0	0.4	
86.2	88.6	
88.8	92.0	
103.2	103.4	
106.6	107.9	
111.6	113.9	
121.6	132.2	

736

Twp:- Roads

Crown West Resources Ltd.

Range 2-66/4E

HOLE NO. 1958-2-66

AREA Redwater Basal

DATE 3/09/24

GROUND LEVEL	1654
TOTAL DEPTH	1358.0
CASING	
BIT SIZE 1	5 7/8"
2	—
CASING SIZE	
WATER LEVEL	28.7m

LOG TYPE

LOG	CNDL GAMMA
PROBE NO.	1024
CHART RATIO	100:1
CPS	1000
FIRST READING	1312
LAST READING	—
INTERVAL LOGGED	—
ENGINEER	Jeff Schneider
OPERATOR	Jeff Schneider

DEPTHS		SEAM NO
FROM	TO	
1654	1432	6
1431	1320	7
1094	1068	8
1067	1044	9
1043	1025	10

736

2-66

31/32