

PR 66-31

AUSTRALIAN AQUITAINE PETROLEUM
PTY. LTD.

KULSHILL No. 2

VELOCITY SURVEY - SONIC CALIBRATION
AUGUST, 1966

O.P.2

OPEN FILE

SOCIÉTÉ GÉNÉRALE DE GÉOPHYSIQUE

D.P. = Ground Level

Sect.

1-2

COORDINATES OF THE WELL LOCATION

LONGITUDE X : 129° 32' 39" E.

LATITUDE Y : 14° 24' 09" S.

Z KB : 154 ft

Z GL : 138 ft

DEPTH OF WELL : 6,432 ft

DEPTH OF CASING : 2,501 ft

MEASUREMENT RECORDED BY : C.G.G. X. 6526

COMPAGNIE GENERALE DE GEOPHYSIQUE

DEPT OF MINES & ENERGY
DO NOT REMOVE



P00998

NORTHERN TERRITORY
GEOLOGICAL SURVEY

PR66/7A

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LOCATION MAP

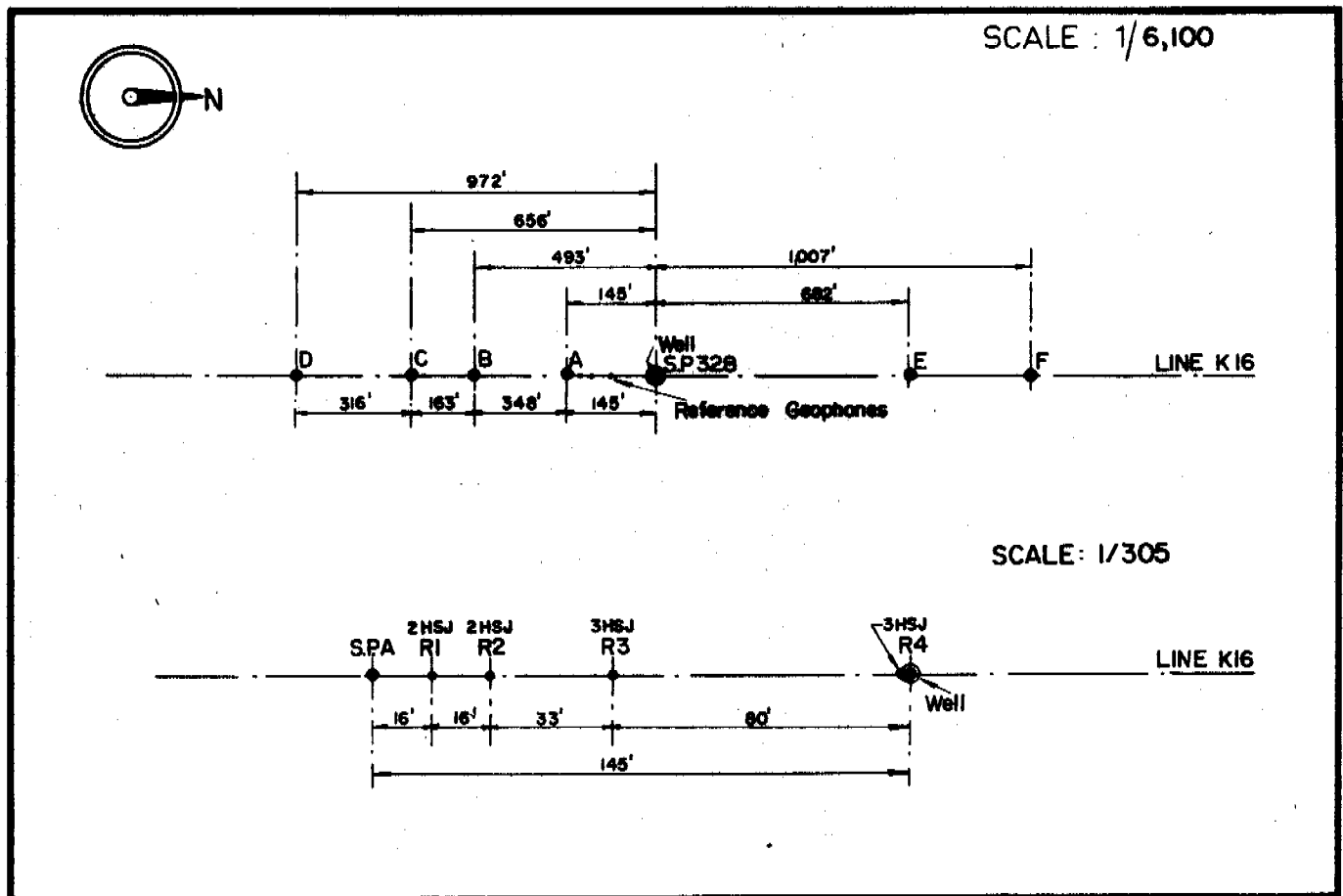
Tb. 2

Z KB : 154 ft

WELL : KULSHILL NO. 2

Z GL : 138 ft

Shot point	Number	Distance	Z	ΔZ	Shot point	Number	Distance	Z	ΔZ
A		145 ft	142 ft	+4.0 ft					
B		493	139.9	+1.9 ft					
C		656	137.8	-0.2 ft					
D		972	135.1	-2.9 ft					
E		682	147	+9.0 ft					
F		1,007	145.3	+7.3 ft					
Reference geophones :									
1		129 ft	142 ft						
2		112	142						
3		80	142						
4		0	138						



HISTORICAL and STATISTICAL Tb.3a

Observer CGG: R. Feenaghty	OPERATIONS		
	Date	Time first shot	Time last shot
	4th August, 1966	7.30 a.m.	1.10 p.m.
Observer SPE: J. Cleret			
No. of holes drilled: -	Tested levels: 15	Records computed: 18	
No. of holes shot: -	Records taken: 18	Explosives used: 2,897 lbs	
Departure from Brisbane : 2nd August, 1966			
Velocity survey carried out on August 4th, 1966			
Return to Brisbane : 5th August 1966			

TECHNICAL

RECORDING EQUIPMENT :-	Recorder : SIE P11
	Camera : SIE PRO 11 25 traces
GEOPHONES :-	<u>WELL</u> 1 Gulf pressure geophone, type GCE 101
	4 Hall Sears Junior geophones, type HSJ-K,
	20 cycles per second, connected in series - parallel
	in a 7/10 pin adaptor to Schlumberger pot-head.
	<u>REFERENCE</u> Hall Sears Junior type HSJ-K, 20 cycles per second.
CONNECTION OF TRACES:-	
Trace 1 :	Time-break
2 :	HS-J Well geophones, low gain, Filters out -92, AGC : OFF
3 :	" " , high gain, " "
4 :	Gulf Well geophone , low gain, " "
5 :	" " , medium gain, " "
6 :	" " , high gain, " "
7 :	" " , medium gain, " AGC : ON
8 :	Reference 1 : 2 grouped HSJ geophones, Filters out -92, AGC: OFF
9 :	" 2 : 2 grouped HSJ geophones, " "
10 :	" 3 : 3 grouped HSJ geophones, " "
11 :	" 4 : 3 grouped HSJ geophones, " "
From shot 9 on, the Gulf geophone was connected to traces 2 and 3, and the HSJ geophones to traces 4, 5, 6, 7.	
The 5th reference geophone was not used because of a fault in the corresponding amplifier of the recorder	

(CONT.)

MEASUREMENTS

a) Recording conditions :

The survey was carried out by day.

Weather was fine.

All shots were on the surface of the ground.

The Well geophones insulation was good before and after the survey.

The Gulf geophone did not function well : it seemed to work until about half way down and then practically ceased until half way up. This could be due to the presence of mica and other additives to the mud which, when cleaning the geophones after the survey, was found to be nothing but fluid. The geophone was in good condition when checked after removal from the hole.

The reference geophones were located in order to allow a determination of the velocity and thickness of the weathering zone.

b) Quality of the records :

All breaks on the records are downwards.

Breaks on the Well geophones were pickable on all records. The quality of the records is as following :

Shots 8	:	Doubtful
1, 2, 3, 7, 9, 10, 11, 12 18	:	Poor
4, 5, 6, 13, 14, 15, 16, 17	:	Fair

COMPUTATION AND CORRECTIONS

1 DATUM PLANE

Times and velocities are computed from the ground level of the Well (138 ft above m. s. l.)

2 WEATHERING ZONE (See Tb. 6)

- Determined at shot points A, C, D, E, F using the reference geophones (traces 8 to 11 of the records)
- Results obtained from shot point B showed a discrepancy with the other records and were not taken into account

- Results are as follows :

6 feet at 1,100 ft/sec.

33 feet at 4,000 ft/sec.

The values adopted for the velocity and the intercept of the layer below the weathering are average values from SP C, D, E, F.

Tb = 24 milliseconds

V1 = 6,850 ft/sec.

3 CORRECTIONS

- The second case of Index of Corrections (Tb 5) was used for all shots.
- The weathering corrections are :

$$\frac{6}{1.1} - \frac{33}{4.0} + \frac{39}{6.85} = .8 \text{ milliseconds}$$

- It was not taken into account in the computation of corrected times.
- Elevation corrections to the ground level of the well were calculated with a velocity of 6,850 ft/sec.

SONIC CALIBRATION

1 INTEGRATOR CALIBRATION Q

First run from 424 to 2494 ft

before survey Q = 1.000

after survey Q = 0.999

Second run

before survey Q = 1.001

after survey Q = 1.002

These coefficients are the average values for 50 and 100 microseconds per foot interval transit time and represent the value in milliseconds read on the sonic log.

INTERPRETATION of the RESULTS Tb.4 b

2 SONIC CALIBRATION (See Tb 8 and 11)

A discrepancy was found between shots from either side of the well. It appeared that times recorded from shot points E and F were shorter than from shot points A, B, C, D.

This could be due to an anisotropy factor.

The sonic calibration was done using shots from one side only (shot points A, B, C, D).

From zero to about 3,500 ft

$$C = +21 \text{ milliseconds}$$

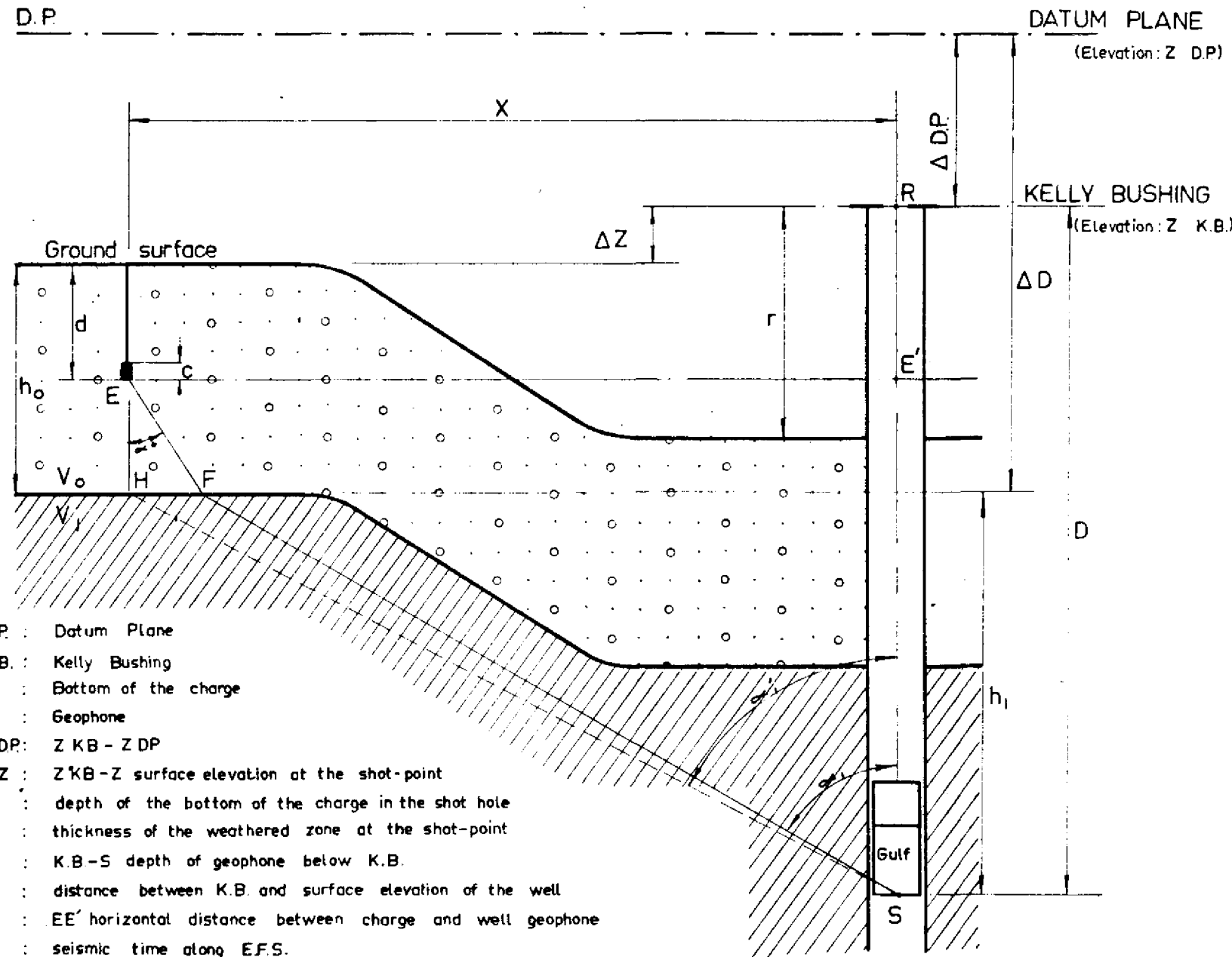
$$K = +1.7 \text{ microsecond / foot}$$

From 3,500 ft to total depth

$$C = +27 \text{ milliseconds}$$

$$K = 0$$

INDEX OF ABBREVIATIONS



- D.P. : Datum Plane
- K.B. : Kelly Bushing
- E : Bottom of the charge
- S : Geophone
- ΔDP : Z K.B. - Z D.P.
- ΔZ : Z K.B. - Z surface elevation at the shot-point
- d : depth of the bottom of the charge in the shot hole
- h_0 : thickness of the weathered zone at the shot-point
- D : K.B.-S depth of geophone below K.B.
- r : distance between K.B. and surface elevation of the well
- X : EE' horizontal distance between charge and well geophone
- T : seismic time along E.F.S.
- ΔT : seismic time along E.F.
- T' : T - ΔT
- V_0 : vertical velocity in the weathered zone
- V_1 : vertical velocity below the weathered zone
- c : height of charge

INDEX OF CORRECTIONS

1st CASE : SHOT on the BOTTOM of the WEATHERED ZONE ($d = h_0$) or BELOW the WEATHERED ZONE ($d > h_0$)

T (raw time read on the record) = T' ($\Delta T = 0$)

T'' Recorded time reduced to the vertical $T' \times \frac{h_1}{L}$ where $h_1 = D - (d \pm \Delta Z)$
 $L = \sqrt{X^2 + h_1^2}$

T''' Corrected time from D.P. = $T'' + t$ where $t = \frac{\Delta D}{V_1}$ and $\Delta D = d \pm \Delta Z \pm \Delta DP$

2nd CASE : SHOT on the SURFACE ($d = 0$)

T' (Recorded time - time of path in the weathered zone) = $T - \Delta T$ where ΔT (seismic time in the weathered zone) = $\frac{h_0}{V_0 \cos \alpha'_0}$

T'' Time below the weathered zone reduced to the vertical = $T' \times \frac{h_1}{L}$ where $h_1 = D - (h_0 \pm \Delta Z)$
 $L = \sqrt{h_1^2 + (X - h_0 \tan \alpha'_0)^2}$

T''' Corrected time from D.P. = $T'' + t$ where $t = \frac{\Delta D}{V_1}$ and $\Delta D = h_0 \pm \Delta Z \pm \Delta DP$

α'_0 is determined by $\sin \alpha'_0 = \sin \alpha_0 \frac{V_0}{V_1}$ and $\sin \alpha_0 = \frac{X}{\sqrt{X^2 + h_0^2}}$

It is proved that no noticeable error is made considering:

α'_0 maximum angle = α_0 real angle

α'_0 approximate angle = α_0 real angle

3rd CASE : SHOT in the WEATHERED ZONE ($d \neq 0$)

Compute T' , T'' and T''' as in the second case, using $\Delta T = \frac{h_0 - d}{V_0 \cos \alpha'_0}$

and $L = \sqrt{h_1^2 + [X - (h_0 - d) \tan \alpha'_0]^2}$

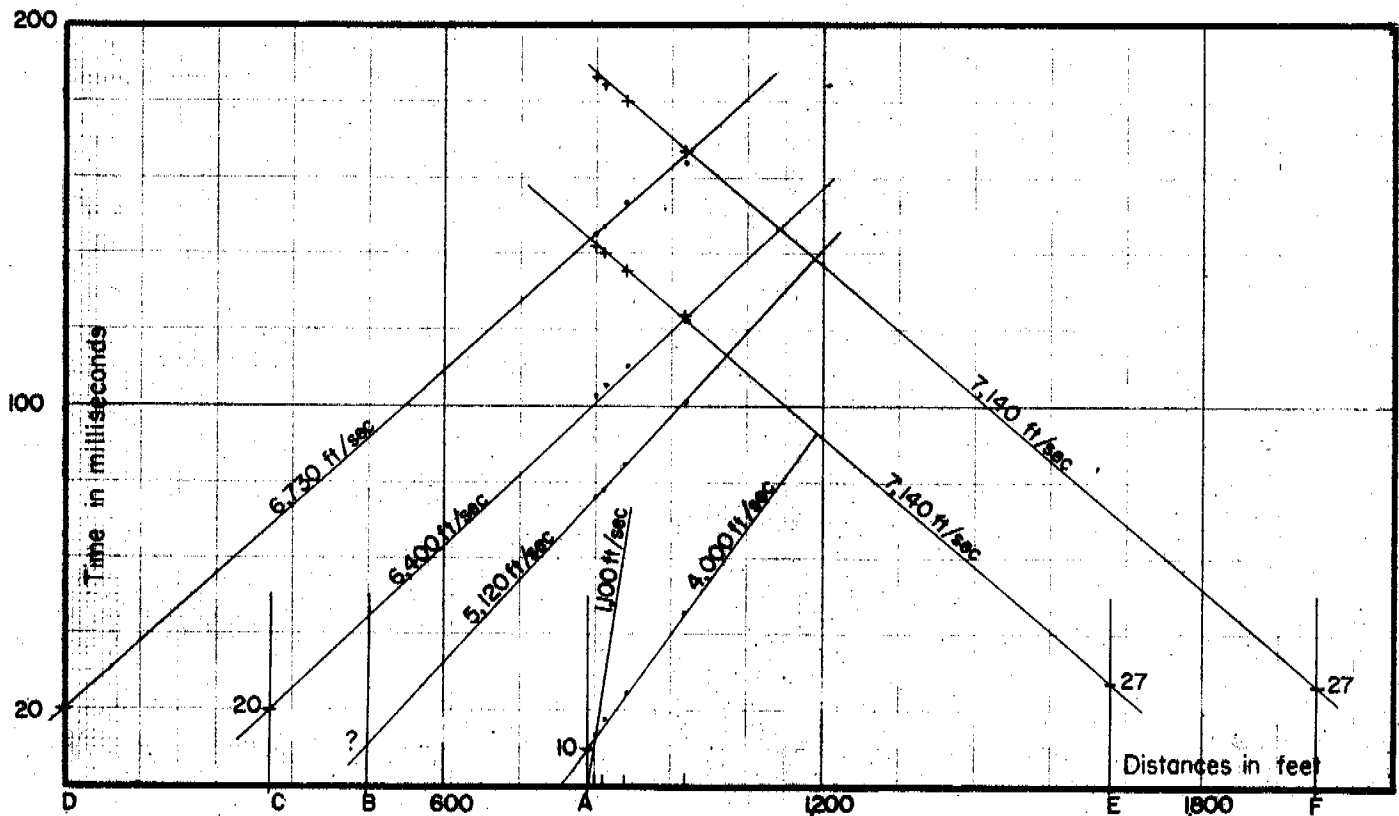
NOTE : It will be admitted therefore, that in these three cases, the seismic travel F.S. is not affected by noticeable refraction effects.

The second case was used for all shots at Kulshill No. 2

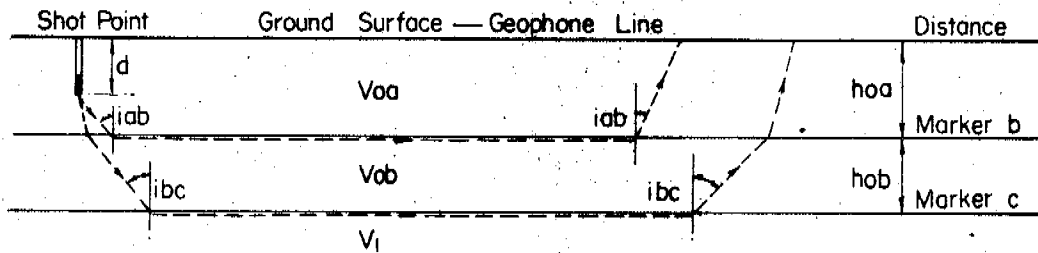
WEATHERED ZONE

Tb. 6

(Velocity and Depth Determination)



PRINCIPLE AND ABBREVIATIONS



COMPUTATION

$$h_{oa} = \frac{d}{2} + \frac{T_a}{2} \times \frac{V_{oa}}{\cos i_{ab}} \quad \text{where } \cos i_{ab} \text{ is determined by } \sin i_{ab} = \frac{V_{oa}}{V_b}$$

$$h_{ob} = \frac{T_b}{2} \times \frac{V_{ob}}{\cos i_{bc}} - h_{oa} \times \frac{V_{ob}}{V_{oa}} \times \frac{\cos i_{ac}}{\cos i_{bc}} \quad \text{with } \sin i_{bc} = \frac{V_{ob}}{V_1} \text{ and } \sin i_{ac} = \frac{V_{oa}}{V_1}$$

Ta = 10
Tb = 24
Tc =

Voa = 1,100 ft/sec
Vob = 4,000 ft/sec
V₁ = 6,800 ft/sec

on the time distance curve

h_{oa} = 6 feet at 1,100 feet per second
h_{ob} = 33 feet at 4,000 feet per second

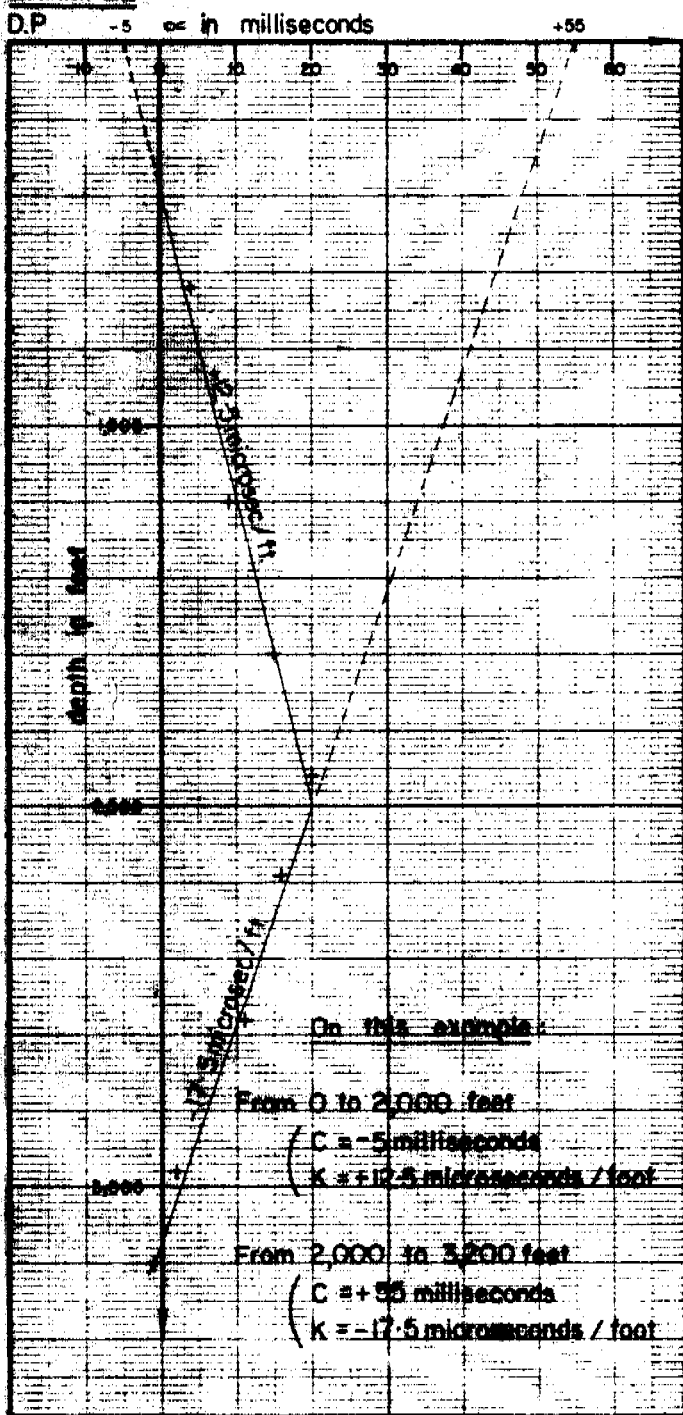
MEASUREMENT and COMPUTATION

SHOT POINT		No. of SHOT		D feet	d feet	ΔZ feet	feet	h _i	X feet	Sin α'	Sin $\alpha'o$	Cos $\alpha'o$	Tg $\alpha'o$	ΔT	L	$\frac{h_i}{L}$	t	T	T'	T''	T'''
Row	Hole	Down	Up																		
A		1		300	2	12.0	-2.0	286	145						321	0.893	-0.3	54 ?		48.2	47.9
B		2		1,200	-	14.1	-2.9	1,185.9	493						1,284	0.924	-0.4	169		156.2	155.8
B		3		2,200	-	14.1	-1.9	2,185.9	493						2,241	0.975	-0.3	267 ?	266	260.3	260.0
C		4		2,900	-	16.2	+0.2	2,883.8	656						2,958	0.975	-	332		323.7	323.7
C		5		3,800	-	16.2	+0.2	3,783.8	656						3,838	0.986	-	416		410.2	410.2
E		6		3,800	-	7.0	-9.0	3,795	682						3,856	0.984	-1.3	406		399.5	398.2
D		7		4,500	-	13.1	-2.9	4,486.9	972						4,591	0.977	-0.4	472		461.1	460.7
D		8		5,500	-	13.1	-2.9	5,486.9	972						5,572	0.985	-0.4	547 ?		538.8	538.4
D		9		6,420	-	13.1	-2.9	6,406.9	972						6,480	0.989	-0.4	623 ?		616.1	615.7
F		10		6,420	-	8.7	-7.3	6,411.3	1,007						6,490	0.988	-1.1	599		591.8	590.7
D		11		5,950	-	13.1	-2.9	5,936.9	972						6,016	0.987	-0.4	576		568.5	568.1
D		12		5,000	-	13.1	-2.9	4,986.9	972						5,081	0.981	-0.4	515 ?		505.2	504.8
D		13		4,000	-	13.1	-2.9	3,986.9	972						4,104	0.971	-0.4	441		428.2	427.8
F		14		4,000	-	8.7	-7.3	3,991.3	1,007						4,116	0.970	-1.1	430		417.1	416.0
C		15		3,300	-	16.2	+0.2	3,283.8	656						3,349	0.981	-	370		363.0	363.0
C		16		2,550	-	16.2	+0.2	2,533.8	656						2,618	0.968	-	306		296.2	296.2
B		17		1,700	-	14.1	-1.9	1,685.9	493						1,757	0.960	-0.3	219		210.2	209.9
B		18		800	-	14.1	-1.9	785.9	493						928	0.847	-0.3	135		114.3	114.0

SONIC CALIBRATION

Principle and Abbreviations

EXAMPLE



b: Seismic corrected times
a: Times read on the sonic log from an arbitrary origin. This origin is chosen so that the difference $\alpha = b - a$ is small

-The value of α (positive or negative for each calibration point is plotted on a diagram, in relation to the depth D) in feet .

-The points are joined with segments of a straight line the breaks of which must correspond to layer changes and / or to noticeable velocity contrasts .

- The equations of these segments determine :

1- the ordinate of the origin : Calibration constant C in msec.

2- the gradient: Calibration factor K in microsec / foot .

- Thus , C and $K \times D$ are algebraically added to each raw sonic time (a).to obtain the corresponding sonic corrected time .

NOTE : Ideal conditions of calibration :

α = Constant for all calibration points, whence: $C = \alpha$ and $K = 0$.

SONIC CALIBRATION

Tb. 9

a

Sonic corrected time = Sonic raw time + (K × D) + calibration constant

K: calibration factor in microseconds./foot (See Tb. 10.)

ORIGIN: Ground Level

	Depth in feet from K.B.	Depth in feet from D.P.	Sonic raw time a	Seismic corrected time b	α (b-a)	K × D	Calibration constant c	Sonic corrected time	Average vertical velocity ft./sec	Interval velocity
A	300	284		47.9			seismic	47.9	5,900	
	437	421	50			+0.7	+21	71.7	5,900	
	492	476	56			0.8		77.8	6,100	
	532.4	516.4	61			0.9		82.9	6,250	
	568.1	552.1	65			1.0		87.0	6,350	
	610.2	594.2	70			1.0		92.0	6,450	
	717.7	701.7	82			1.2		104.2	6,700	
	788.4	772.4	90			1.3		112.3	6,850	
B	800	784	91.3	114.0	+22.7	1.4		113.7	6,900	
	861.9	845.9	98			1.5		120.5	7,000	
	1,010.7	994.7	114			1.7		136.7	7,300	
	1,117	1,101	125			1.9		147.9	7,450	
B	1,200	1,184	133.5	155.8	+22.3	2.0		156.5	7,550	
	1,303.2	1,287.2	144			2.2		167.2	7,700	
	1,401.4	1,385.4	155			2.4		178.4	7,750	
	1,582.7	1,566.7	174			2.7		197.7	7,900	
	1,678.5	1,662.5	184			2.9		207.9	8,000	
B	1,700	1,684	186.1	209.9	+23.8	2.9		210.0	8,000	
	1,827.8	1,811.8	199			3.1		223.1	8,150	
	1,932	1,916	209			3.3		233.3	8,200	
	2,015	1,999	217			3.4		241.4	8,300	
	2,090	2,074	224			3.5		248.5	8,350	
	2,137.8	2,121.8	229			3.6		253.6	8,400	
B	2,200	2,184	234.3	260.0	+25.7	3.7		259.0	8,450	
	2,242.3	2,226.3	238			3.8		262.8	8,500	
	2,395.8	2,379.8	253			4.1		278.1	8,550	
	2,442	2,426	257			4.2		282.2	8,600	
	2,510	2,494	263			4.3		288.3	8,650	
c	2,550	2,534	266.5	296.2	+29.7	4.3		291.8	8,700	
	2,605	2,589	271			4.4		296.4	8,750	
	2,688	2,672	279			4.6		304.6	8,800	
	2,758	2,742	286			4.7		311.7	8,800	
	2,841	2,825	294			4.8		319.8	8,850	
C	2,900	2,884	299.5	323.7	+24.2	4.9		325.4	8,900	
	3,011	2,995	310			5.1		336.1	8,900	
	3,144	3,128	322			5.3		348.3	8,950	
	3,240	3,224	330			5.5		356.5	9,000	
C	3,300	3,284	335.9	363.0	+27.1	5.6		362.5	9,050	
	3,311	3,295	337			5.6		363.6	9,050	
	3,417.5	3,401.5	347			5.8	+21	373.8	9,100	
	3,505	3,489	354			0	+27	381.0	9,150	
	3,569	3,553	360			0	+27	387.0	9,150	

SONIC CALIBRATION

Tb. 9

b

Sonic corrected time = Sonic raw time + (K × D) + calibration constant

K: calibration factor in microseconds/foot (See Tb. 10.)

ORIGIN: Ground Level

	Depth in feet from K.B.	Depth in feet from D.P.	Sonic raw time a	Seismic corrected time b	α (b-a)	K × D	Calibration constant c	Sonic corrected time	Average vertical velocity ft./sec	Interval velocity
	3.673	3.657	369			0	+27	396	9,200	
	3.736.3	3.720.3	375					402	9,250	
C	3.800	3.784	380.4	410.2	+29.8			407.4	9,300	
E	3.800	3.784	380.4	398.2	+17.8			407.4	9,300	
	3.844	3.828	384					411	9,300	
	3.923.7	3.907.7	391					418	9,350	
D	4.000	3.984	397.3	427.8	+30.5			424.3	9,400	
F	4.000	3.984	397.3	416.0	+18.7			424.3	9,400	
	4.008	3.992	398					425	9,400	
	4,126.5	4,110.5	407					434	9,450	
	4,191	4,175	412					439	9,500	
	4,284	4,268	419					446	9,550	
	4,411	4,395	429					456	9,600	
D	4,500	4,484	435.8	460.7	+24.9			462.8	9,650	
	4,603	4,587	444					471	9,700	
	4,692.6	4,676.6	451					478	9,750	
	4,755	4,739	456					483	9,800	
	4,941	4,925	470					497	9,900	
D	5,000	4,984	474.7	504.8	+30.1			501.7	9,950	
	5,039	5,023	478					505	9,950	
	5,106.6	5,090.6	483					510	9,950	
	5,154	5,138	487					514	10,000	
	5,268	5,252	496					523	10,050	
	5,332	5,316	501					528	10,050	
	5,455	5,439	510					537	10,100	
D	5,500	5,484	513.8	538.4	+24.6			540.8	10,100	
	5,526	5,510	516					543	10,150	
	5,568	5,552	519					546	10,150	
	5,601.7	5,585.7	522					549	10,200	
	5,706	5,690	530					557	10,200	
	5,774	5,758	535					562	10,250	
	5,858.7	5,842.7	541					568	10,250	
D	5,950	5,934	547.9	568.1	+20.2			574.9	10,300	
	6,001.7	5,985.7	552					579	10,300	
	6,075	6,059	558					585	10,350	
	6,126.3	6,110.3	562					589	10,350	
	6,213	6,197	569					596	10,400	
	6,281.6	6,265.6	574					601	10,400	
	6,332	6,316	578					605	10,450	
D	6,420	6,404	584.3	615.7	+31.4			611.3	10,500	
F	6,420	6,404	584.3	590.7	+ 6.4			611.3	10,500	
	6,430	6,414	585			0	+27	612	10,500	

SONIC INTERVAL VELOCITIES

Tb. 10^a

Z KB: 154 ft

ORIGIN: Ground Level

Z GL: 138 ft

Depth in feet from K.B.	Depth in feet from D.P.	Sonic corrected time in milliseconds.	Interval depth	Interval time	Interval velocity in feet/second
437	421	71.7			
			55	6.1	9.150
492	476	77.8			
			40.4	5.1	7.900
532.4	516.4	82.9			
			35.7	4.1	8.700
568.1	552.1	87.0			
			42.1	5	8.400
610.2	594.2	92.0			
			107.5	12.2	8.800
717.7	701.7	104.2			
			70.7	8.1	8.700
788.4	772.4	112.3			
			73.5	8.2	9.000
861.9	845.9	120.5			
			148.8	16.2	9.200
1010.7	994.7	136.7			
			106.3	11.2	9.500
1117	1101	147.9			
			186.2	19.3	9.650
1303.2	1287.2	167.2			
			98.2	11.2	8.800
1401.4	1385.4	178.4			
			181.3	19.3	9.400
1582.7	1566.7	197.7			
			95.8	10.2	9.400
1678.5	1662.5	207.9			
			149.3	15.2	9.850
1827.8	1811.8	223.1			
			104.2	10.2	10.200
1932	1916	233.3			
			83	8.1	10.250
2015	1999	241.4			
			75	7.1	10.550
2090	2074	248.5			
			47.8	5.1	9.400
2137.8	2121.8	253.6			
			104.5	9.2	11.350
2242.3	2226.3	262.8			
			153.5	15.3	10.000
2395.8	2379.8	278.1			
			46.2	4.1	11.300
2442	2426	282.2			
			68	6.1	11.150
2510	2494	288.3			
			95	8.1	11.750
2605	2589	296.4			

SONIC INTERVAL VELOCITIES

Tb. 10^b

Z KB: 154 ft

ORIGIN : Ground Level

Z GL: 138 ft

Depth in feet from K.B.	Depth in feet from D.P.	Sonic corrected time in milliseconds.	Interval depth	Interval time	Interval velocity in feet/second
2605	2589	296.4			
			83	8.2	10,100
2688	2672	304.6			
			70	7.1	9,850
2758	2742	311.7			
			83	8.1	10,250
2841	2825	319.8			
			170	16.3	10,400
3011	2995	336.1			
			133	12.2	10,900
3144	3128	348.3			
			96	8.2	11,700
3240	3224	356.5			
			71	7.1	10,000
3311	3295	363.6			
			106.5	10.2	10,450
3417.5	3401.5	373.8			
			87.5	7.2	12,150
3505	3489	381.0			
			64	6	10,700
3569	3553	387.0			
			104	9	11,550
3673	3657	396			
			63.3	6	10,550
3736.3	3720.3	402			
			107.7	9	11,950
3844	3828	411			
			79.7	7	11,400
3923.7	3907.7	418			
			84.3	7	12,050
4008	3992	425			
			118.5	9	13,150
4126.5	4110.5	434			
			64.5	5	12,900
4191	4175	439			
			93	7	13,300
4284	4268	446			
			127	10	12,700
4411	4395	456			
			192	15	12,800
4603	4587	471			
			89.6	7	12,800
4692.6	4676.6	478			
			62.4	5	12,500
4755	4739	483			
			186	14	13,300
4941	4925	497			

KULSHILL No.2

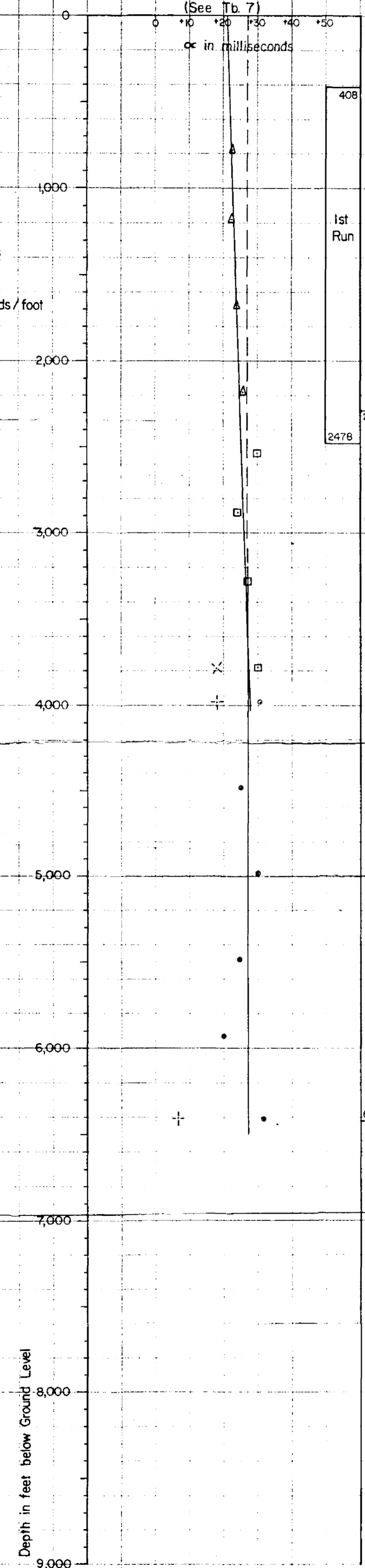
SONIC CALIBRATION
C and K graphic determination
(See Tb. 7)

LOG

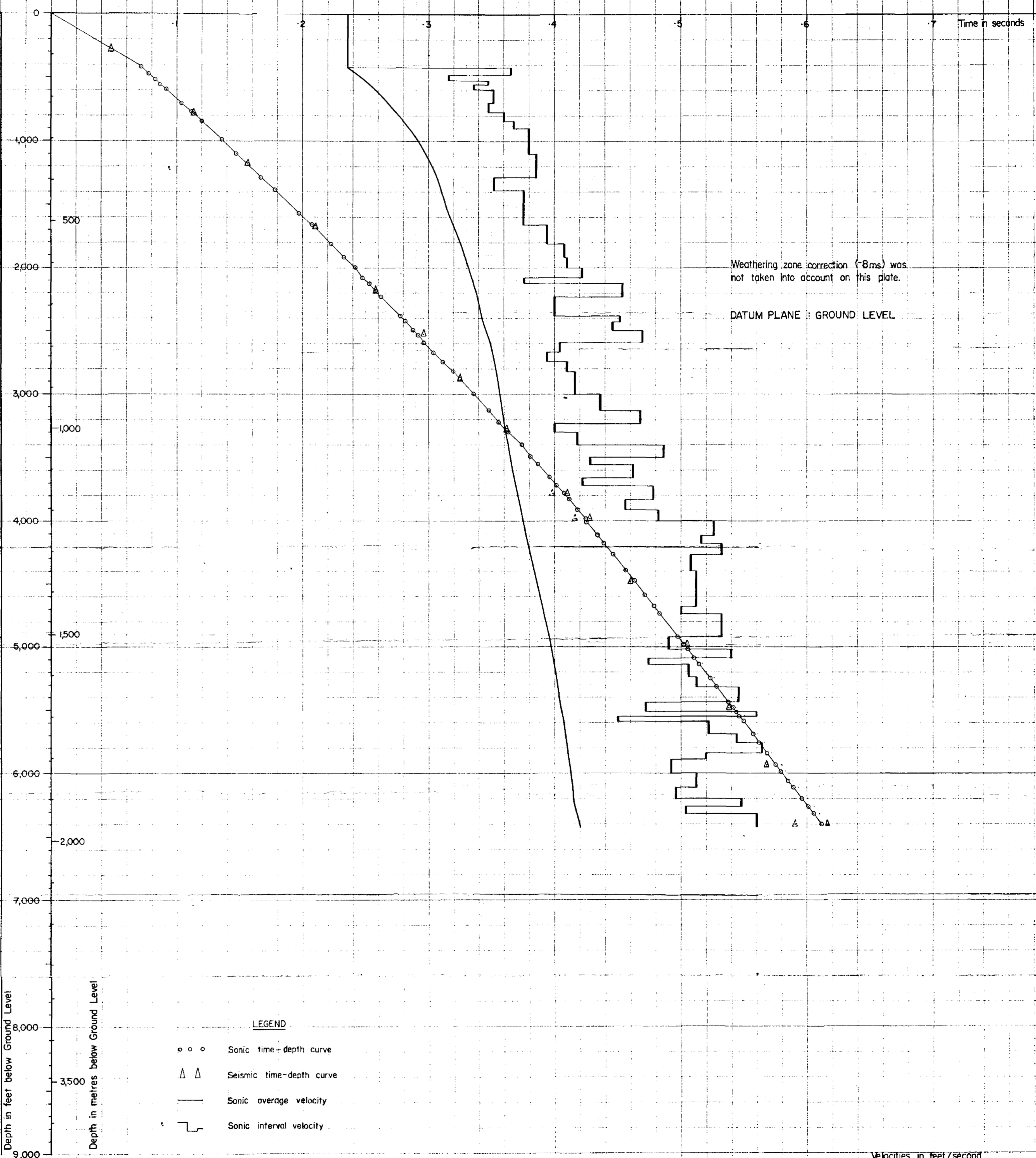
- △ Shot Point B
- Shot Point C
- Shot Point D
- × Shot Point E
- + Shot Point F

Calibration Coefficients
From 0 to 3,500'
C = + 21 milliseconds
K = + 17 microseconds/foot

From 3,500' to T.D.
C = + 27 milliseconds
K = 0



Sugar Loaf Shales	204'
Greywacke Member	
Tillitic Member	2354'
Basal Quartzitic Member	3509'
Member I Milligan and Wallaby Formation	
MILLIGAN FORMATION	
UPPER CARBONIFEROUS PERMIAN	4903'
UPPER CARBONIFEROUS - LOWER PERMIAN	5877'



Weathering zone correction (.8ms) was not taken into account on this plate.

DATUM PLANE: GROUND LEVEL

- LEGEND
- ○ ○ Sonic time-depth curve
 - △ △ Seismic time-depth curve
 - Sonic average velocity
 - Sonic interval velocity

No. of Shot		1	2	3	4	5	6	7	8		9	10	11	12	13	14	15	16	17	18	19	
Hour of Shot		7.30 am	7.45 am	8.00 am	8.15 am	8.30 am	8.50 am	9.40 am	10.00 am		10.20 am	10.45 am	11.10 am	11.25 am	11.40 am	11.55 am	12.10 pm	12.30 pm	12.40 pm	12.55 pm	1.10 pm	
No of Shot Point		A	B	B	C	C	E	D	D		D	F	D	D	D	F	C	C	B	B	A	
Depth of Well Geophone	metres																					
	feet	300	1200	2200	2900	3800	3800	4500	5500		6420	6420	5950	5000	4000	4000	3300	2550	1700	800		
Shot Point - well distance in feet		145	493	493	656	656	682	972	972		972	1007	972	972	972	1007	656	656	493	493	145	
Depth of charge in feet		2	Surface	Surface	Surface	Surface	Surface	Surface	Surface		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	1
Explosive charge in lbs		0.33	20	40	100	150	150	220	260		300	400	380	240	200	200	125	75	24	10	3	
Total charge in lbs																						
Blasting caps		1	1	1	2	3	3	5	5		6	8	7	5	4	4	3	2	1	1	10	
Time break	1	Gains	Filters																			
Hall Sears Well Geophones	2	G	30/50	35/50	30/50	=	=	=	=		Pressure Well	30/50	35/50	30/50	=	=	=	=	=	=	=	
		F	Out-92	=	=	=	=	=	=		Well	Out-92	=	=	=	=	=	=	=	=	=	
AGC : OFF	3	G	40/50	45/50	40/50	=	=	=	=		Geophone	40/50	45/50	40/50	=	=	=	=	=	=	=	
		F	Out-92	=	=	=	=	=	=		AGC:off	Out-42	=	=	=	=	=	=	=	=	=	
Pressure Well Geophone	4	G	30/50	35/50	30/50	35/50	=	=	30/50		Hall Sears Well	25/50	35/50	=	=	=	=	=	=	=	=	
		F	Out-92	=	=	=	=	=	=		Well	Out-92	=	=	=	=	=	=	=	=	=	
AGC : OFF	5	G	40/50	45/50	40/50	45/50	=	=	40/50		Geophone	35/50	40/50	45/50	=	=	=	=	=	=	=	
		F	Out-92	=	=	=	=	=	=		Well	Out-92	=	=	=	=	=	=	=	=	=	
AGC : OFF	6	G	50/60	60/60	50/60	60/60	=	=	50/60		AGC:off	45/60	60/60	=	=	=	=	=	=	=	=	
		F	Out-92	=	=	=	=	=	=		Well	Out-92	=	=	=	=	=	=	=	=	=	
AGC : ON	7	G	40/50	45/50	40/50	45/50	=	=	40/50		AGC:on	35/50	40/50	50/50	=	=	=	=	=	=	45/50	
		F	Out-92	=	=	=	=	=	=		Well	Out-92	=	=	=	=	=	=	=	=	=	=
Reference Geophones	8	G	20/50	30/50	=	=	=	=	=		Reference	30/50	=	=	=	=	=	=	=	=	=	
		F	Out-92	=	=	=	=	=	=		Geophones	Out-92	=	=	=	=	=	=	=	=	=	=
AGC : OFF	9	G	20/50	30/50	=	=	=	=	=		Geophones	30/50	=	=	=	=	=	=	=	=	=	=
		F	Out-92	=	=	=	=	=	=		Well	Out-92	=	=	=	=	=	=	=	=	=	=
AGC : OFF	10	G	20/50	30/50	=	=	=	=	=		AGC:off	30/50	=	=	=	=	=	=	=	=	=	=
		F	Out-92	=	=	=	=	=	=		Well	Out-92	=	=	=	=	=	=	=	=	=	=
AGC : OFF	11	G	20/50	30/50	=	=	=	=	=			30/50	=	=	=	=	=	=	=	=	=	=
		F	Out-92	=	=	=	=	=	=			Out-92	=	=	=	=	=	=	=	=	=	=
12	G																					
12	F																					
OBSERVATIONS																						

For WZ survey

Client A A P
Well KULSHILL 2

Date D 4 M 8 Y 66
Hour H 7 M 30 am
No of Shot 1
Shot Point A
Depth of well geophone in feet below K B 300
Depth of charge SURFACE
Change in lbs 10-1 DETD
Perforations
Observations POPE
Well geophone GULF
Pressure geophone G.C.E.I.D
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P.II S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A.G.C.
		Input	Output	L.F.	H.F.	
1	Time break					
2	H.S.J. well geophone	30	50	out	92	off
3	H.S.J. well geophone	40				
4	Gulf well geophone	30				
5	Gulf well geophone	40				
6	Gulf well geophone	50	80			off
7	Gulf well geophone	40	50			on
8	Reference 1	30				off
9	2	30				
10	3	30				
11	5	30	50	out	92	off



Client A A P
Well KULSHILL 2

Date D 4 M 8 Y 66
Hour H 7 M 45 am
No of Shot 2
Shot Point B
Depth of well geophone in feet below K B 1,200
Depth of charge SURFACE
Change in lbs 20-1 DETD
Perforations
Observations
Well geophone GULF
Pressure geophone G.C.E.I.D
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P.II S.I.E
Camera PRO II S.I.E

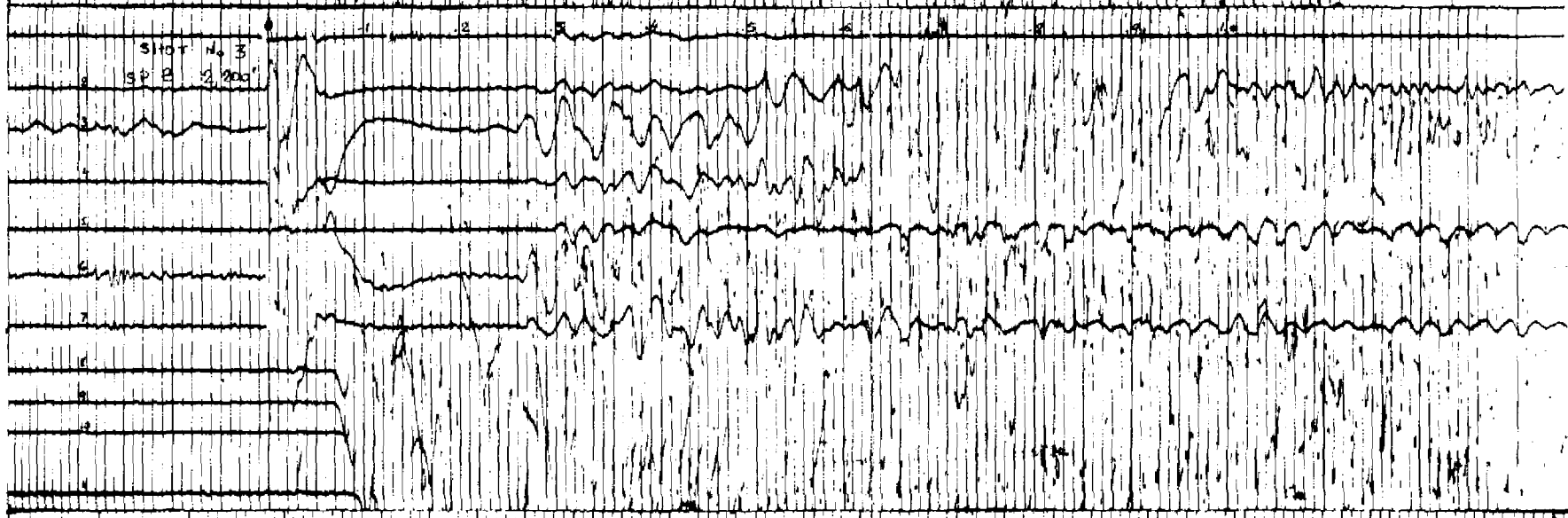
No of Trace	DESIGNATION	GAIN		FILTER		A.G.C.
		Input	Output	L.F.	H.F.	
1	Time break					
2	H.S.J. well geophone	35	50	out	92	off
3	H.S.J. well geophone	45				
4	Gulf well geophone	35				
5	Gulf well geophone	45				
6	Gulf well geophone	60	80			off
7	Gulf well geophone	45	50			on
8	Reference 1	30				off
9	2	30				
10	3	30				
11	5	30	50	out	92	off



Client A A P
Well KULSHILL 2

Date D 4 M 8 Y 66
Hour H 8 M 00 am
No of Shot 3
Shot Point B
Depth of well geophone in feet below K B 2,800
Depth of charge SURFACE
Change in lbs 40-1 DETD
Perforations
Observations POPE
Well geophone GULF
Pressure geophone G.C.E.I.D
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P.II S.I.E
Camera PRO II S.I.E

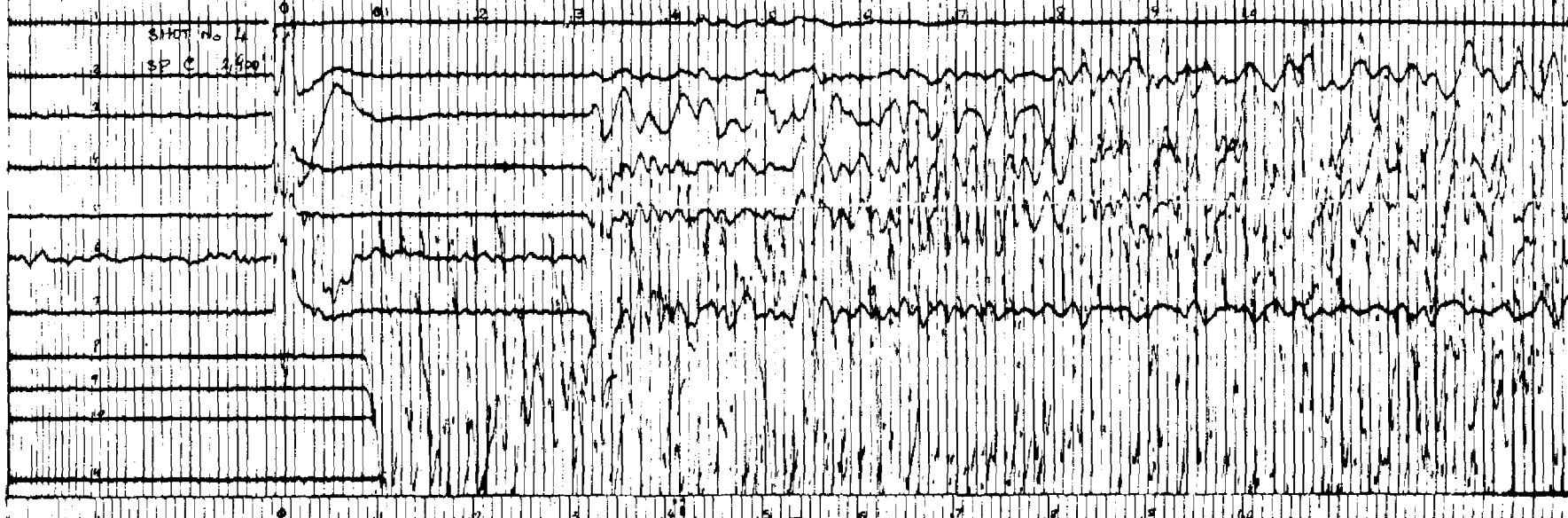
No of Trace	DESIGNATION	GAIN		FILTER		A.G.C.
		Input	Output	L.F.	H.F.	
1	Time break					
2	H.S.J. well geophone	30	50	out	92	off
3	H.S.J. well geophone	40				
4	Gulf well geophone	30				
5	Gulf well geophone	40				
6	Gulf well geophone	50	80			off
7	Gulf well geophone	40	50			on
8	Reference 1	30				off
9	2	30				
10	3	30				
11	5	30	50	out	92	off



Client A A P
Well KULSHILL 2

Date D 4 M 8 Y 66
Hour H 8 M 15 am
No of Shot 4
Shot Point C
Depth of well geophone in feet below K B 2,800
Depth of charge SURFACE
Change in lbs 100-2 DETD
Perforations
Observations
Well geophone GULF
Pressure geophone G.C.E.I.D
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P.II S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A.G.C.
		Input	Output	L.F.	H.F.	
1	Time break					
2	H.S.J. well geophone	30	50	out	92	off
3	H.S.J. well geophone	40				
4	Gulf well geophone	35				
5	Gulf well geophone	45				
6	Gulf well geophone	60	80			off
7	Gulf well geophone	45	50			on
8	Reference 1	30				off
9	2	30				
10	3	30				
11	5	30	50	out	92	off



Client A A P
Well KULSHILL 2

Date D 4 M 8 Y 66
Hour H 8 M 30 am
No of Shot 5
Shot Point C
Depth of well geophone in feet below K B 3,800
Depth of charge SURFACE
Change in lbs 150-3 DETD
Perforations
Observations
Well geophone GULF
Pressure geophone G.C.E.I.D
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P.II S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A.G.C.
		Input	Output	L.F.	H.F.	
1	Time break					
2	H.S.J. well geophone	30	50	out	92	off
3	H.S.J. well geophone	40				
4	Gulf well geophone	35				
5	Gulf well geophone	45				
6	Gulf well geophone	60	80			off
7	Gulf well geophone	45	50			on
8	Reference 1	30				off
9	2	30				
10	3	30				
11	5	30	50	out	92	off



Client A A P
Well KULSHILL 2

Date D 4 M 8 Y 66
Hour H 8 M 50 am
No of Shot 6
Shot Point E
Depth of well geophone in feet below K B 3,800
Depth of charge SURFACE
Change in lbs 150-3 DETD
Perforations
Observations
Well geophone GULF
Pressure geophone G.C.E.I.D
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P.II S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A.G.C.
		Input	Output	L.F.	H.F.	
1	Time break					
2	H.S.J. well geophone	30	50	out	92	off
3	H.S.J. well geophone	40				
4	Gulf well geophone	35				
5	Gulf well geophone	45				
6	Gulf well geophone	60	80			off
7	Gulf well geophone	45	50			on
8	Reference 1	30				off
9	2	30				
10	3	30				
11	5	30	50	out	92	off

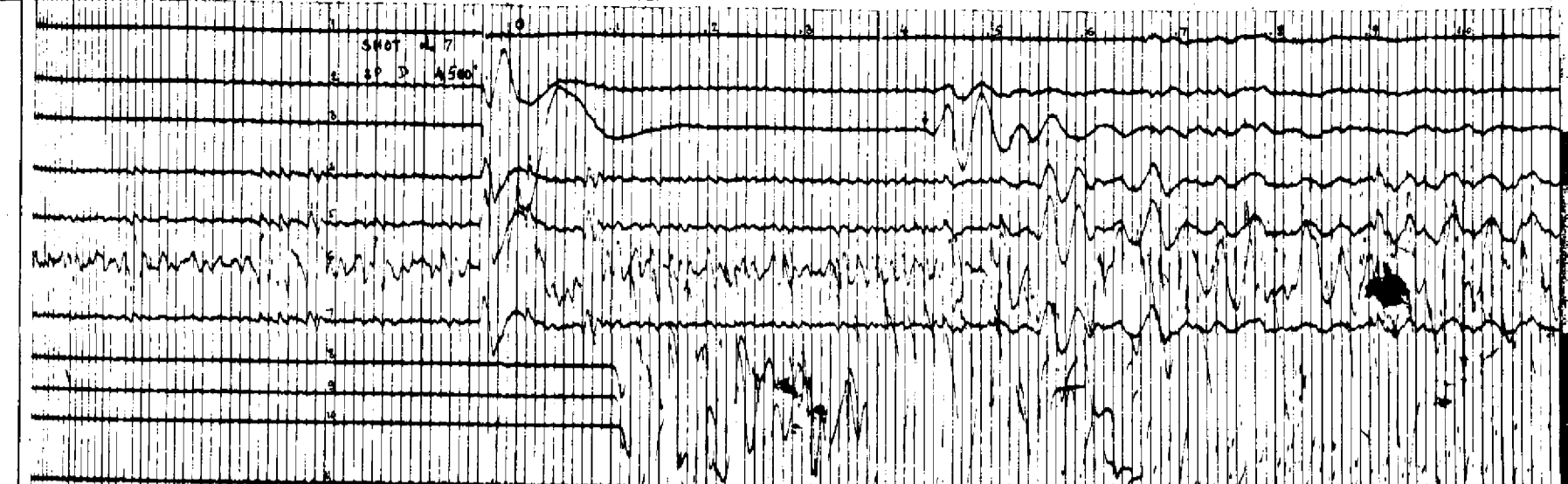


Client A.A.P.
Well KULSHILL 2

Shot No. 7
SP D 4500

Date D 4 M 8 Y 68
Hour H 8 M 40 am
No of Shot 7
Shot Point D
Shot Point to well
Pressure geophone G.C.E. 10
Ref geophones HALL SEARS
Equipment S.I.E.
Amplifiers P11 S.I.E.
Camera PRO II S.I.E.

No. of trace	DESIGNATION	GAIN		FILTER		A.B.C.
		Input	Output	L.F.	H.F.	
1	Time track					
2	H.S.J. well geophone	30	30	cut	92	off
3	H.S.J. well geophone	40			48	
4	H.S.J. well geophone	30			92	
5	H.S.J. well geophone	48	30			
6	H.S.J. well geophone	30	30			off
7	H.S.J. well geophone	48	30			on
8	Reference	30				off
9	2	30				
10	3	30				
11	5	30	30	cut	92	off

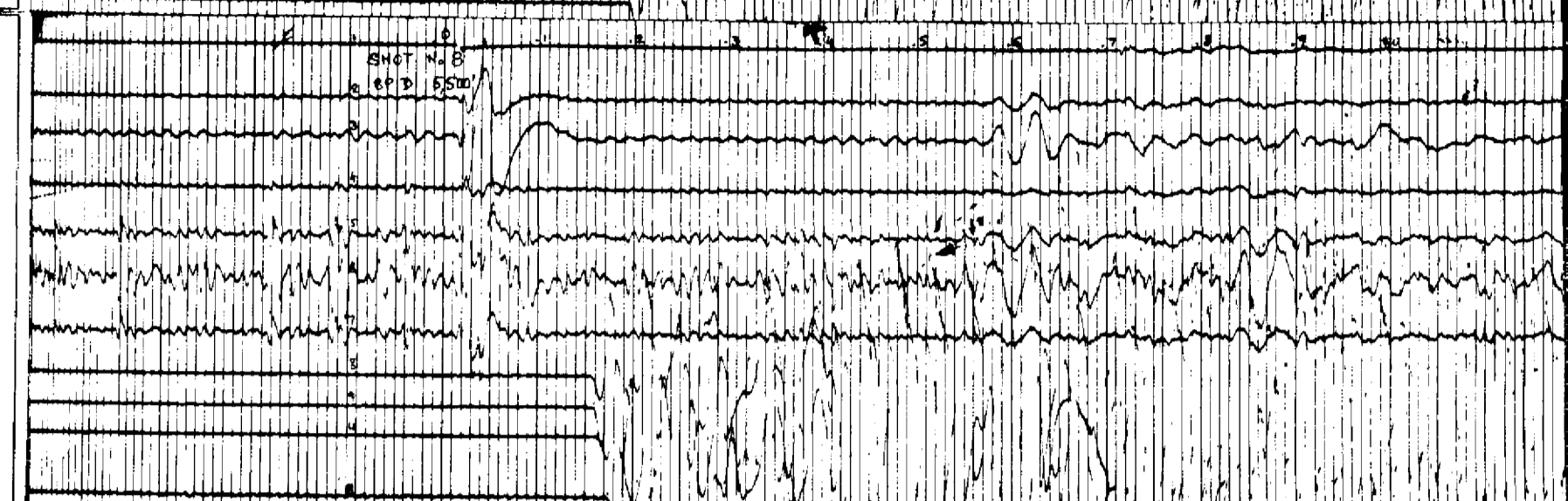


Client A.A.P.
Well KULSHILL 2

Shot No. 8
SP D 5500

Date D 4 M 8 Y 68
Hour H 8 M 40 am
No of Shot 8
Shot Point D
Shot Point to well
Pressure geophone G.C.E. 10
Ref geophones HALL SEARS
Equipment S.I.E.
Amplifiers P11 S.I.E.
Camera PRO II S.I.E.

No. of trace	DESIGNATION	GAIN		FILTER		A.B.C.
		Input	Output	L.F.	H.F.	
1	Time track					
2	H.S.J. well geophone	30	30	cut	92	off
3	H.S.J. well geophone	40			48	
4	H.S.J. well geophone	30			92	
5	H.S.J. well geophone	48	30			
6	H.S.J. well geophone	30	30			off
7	H.S.J. well geophone	48	30			on
8	Reference	30				off
9	2	30				
10	3	30				
11	5	30	30	cut	92	off

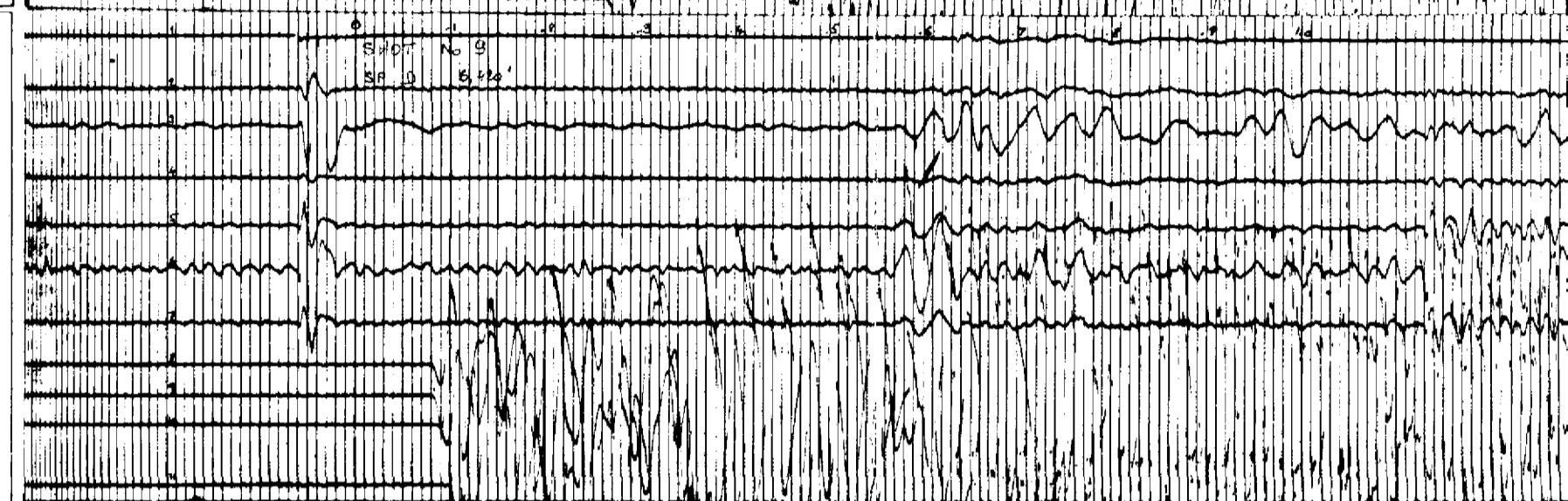


Client A.A.P.
Well KULSHILL 2

Shot No. 9
SP D 6500

Date D 4 M 8 Y 68
Hour H 8 M 40 am
No of Shot 9
Shot Point D
Shot Point to well
Pressure geophone G.C.E. 10
Ref geophones HALL SEARS
Equipment S.I.E.
Amplifiers P11 S.I.E.
Camera PRO II S.I.E.

No. of trace	DESIGNATION	GAIN		FILTER		A.B.C.
		Input	Output	L.F.	H.F.	
1	Time track					
2	H.S.J. well geophone	30	30	cut	92	off
3	H.S.J. well geophone	40			48	
4	H.S.J. well geophone	30			92	
5	H.S.J. well geophone	48	30			
6	H.S.J. well geophone	30	30			off
7	H.S.J. well geophone	48	30			on
8	Reference	30				off
9	2	30				
10	3	30				
11	5	30	30	cut	92	off

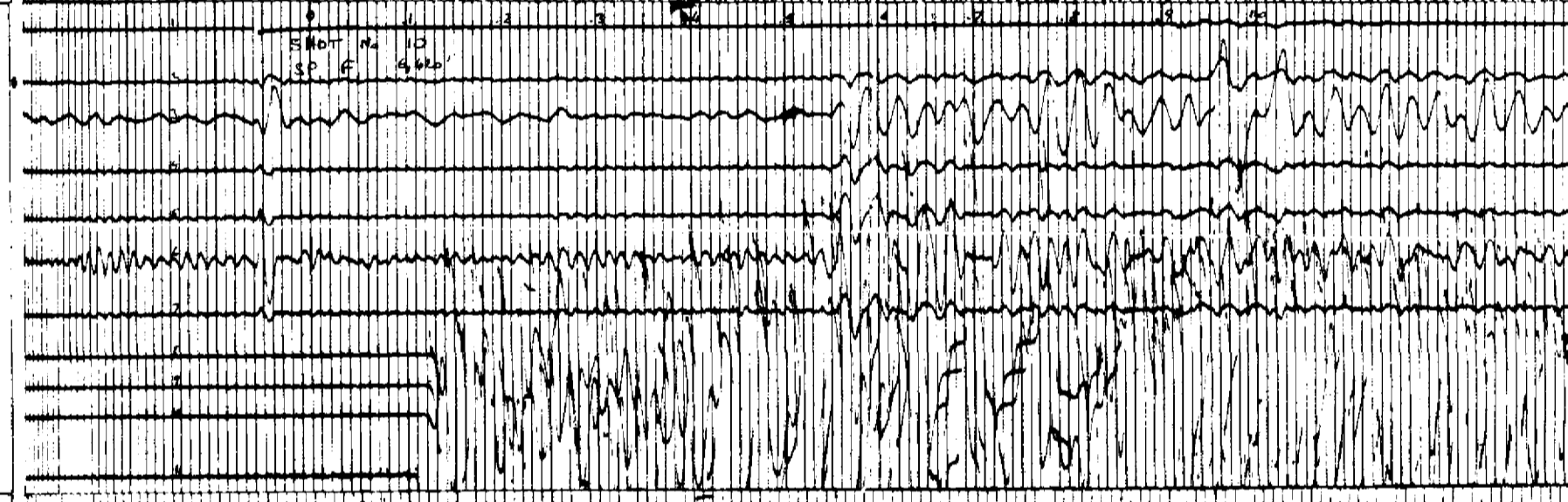


Client A.A.P.
Well KULSHILL 2

Shot No. 10
SP D 4500

Date D 4 M 8 Y 68
Hour H 8 M 40 am
No of Shot 10
Shot Point D
Shot Point to well
Pressure geophone G.C.E. 10
Ref geophones HALL SEARS
Equipment S.I.E.
Amplifiers P11 S.I.E.
Camera PRO II S.I.E.

No. of trace	DESIGNATION	GAIN		FILTER		A.B.C.
		Input	Output	L.F.	H.F.	
1	Time track					
2	H.S.J. well geophone	30	30	cut	92	off
3	H.S.J. well geophone	40			48	
4	H.S.J. well geophone	30			92	
5	H.S.J. well geophone	48	30			
6	H.S.J. well geophone	30	30			off
7	H.S.J. well geophone	48	30			on
8	Reference	30				off
9	2	30				
10	3	30				
11	5	30	30	cut	92	off

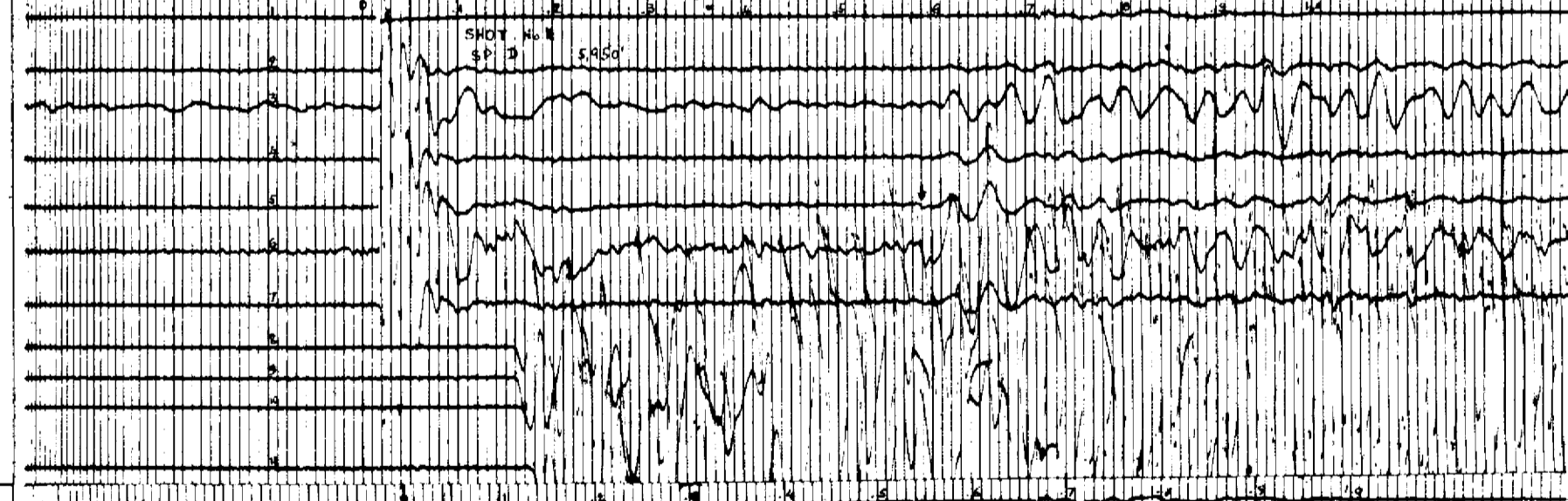


Client A.A.P.
Well KULSHILL 2

Shot No. 11
SP D 5500

Date D 4 M 8 Y 68
Hour H 8 M 40 am
No of Shot 11
Shot Point D
Shot Point to well
Pressure geophone G.C.E. 10
Ref geophones HALL SEARS
Equipment S.I.E.
Amplifiers P11 S.I.E.
Camera PRO II S.I.E.

No. of trace	DESIGNATION	GAIN		FILTER		A.B.C.
		Input	Output	L.F.	H.F.	
1	Time track					
2	H.S.J. well geophone	30	30	cut	92	off
3	H.S.J. well geophone	40			48	
4	H.S.J. well geophone	30			92	
5	H.S.J. well geophone	48	30			
6	H.S.J. well geophone	30	30			off
7	H.S.J. well geophone	48	30			on
8	Reference	30				off
9	2	30				
10	3	30				
11	5	30	30	cut	92	off

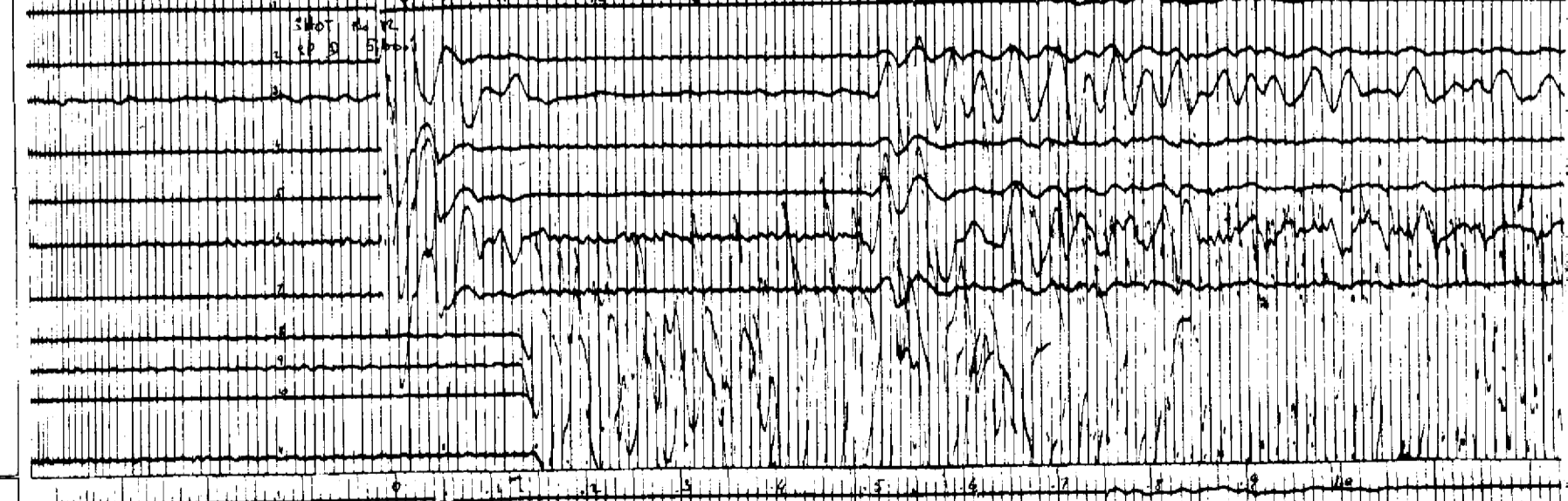


Client A.A.P.
Well KULSHILL 2

Shot No. 12
SP D 5500

Date D 4 M 8 Y 68
Hour H 8 M 40 am
No of Shot 12
Shot Point D
Shot Point to well
Pressure geophone G.C.E. 10
Ref geophones HALL SEARS
Equipment S.I.E.
Amplifiers P11 S.I.E.
Camera PRO II S.I.E.

No. of trace	DESIGNATION	GAIN		FILTER		A.B.C.
		Input	Output	L.F.	H.F.	
1	Time track					
2	H.S.J. well geophone	30	30	cut	92	off
3	H.S.J. well geophone	40			48	
4	H.S.J. well geophone	30			92	
5	H.S.J. well geophone	48	30			
6	H.S.J. well geophone	30	30			off
7	H.S.J. well geophone	48	30			on
8	Reference	30				off
9	2	30				
10	3	30				
11	5	30	30	cut	92	off

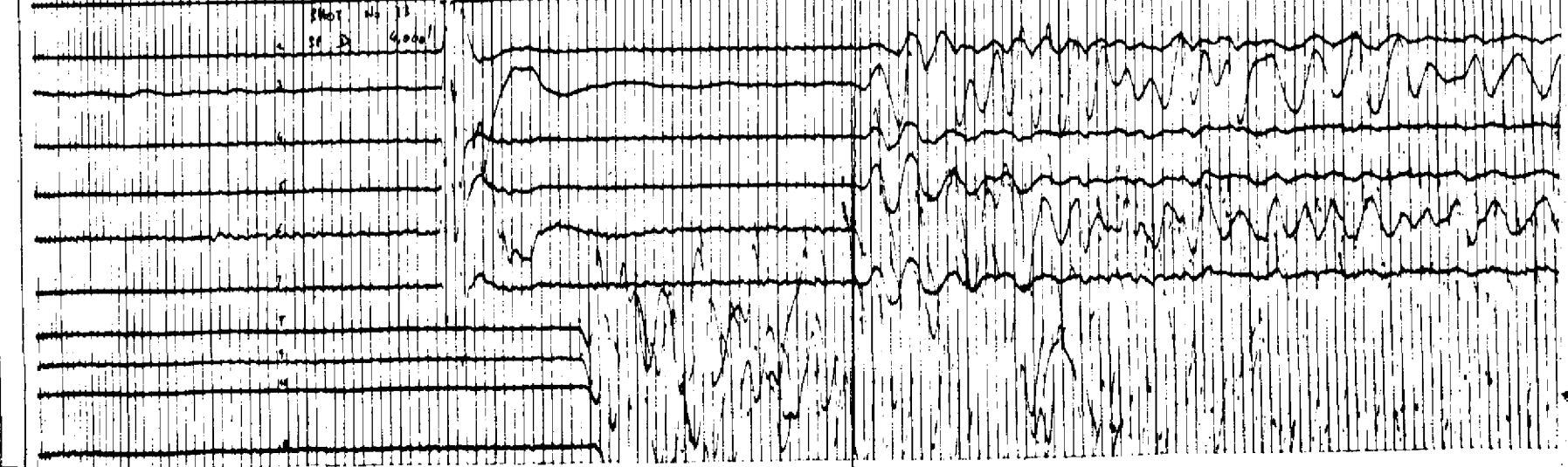


Client A.A.P.
Well KULSHILL 2

Shot No. 13
SP D 4000

Date D 4 M 8 Y 68
Hour H 8 M 40 am
No of Shot 13
Shot Point D
Shot Point to well
Pressure geophone G.C.E. 10
Ref geophones HALL SEARS
Equipment S.I.E.
Amplifiers P11 S.I.E.
Camera PRO II S.I.E.

No. of trace	DESIGNATION	GAIN		FILTER		A.B.C.
		Input	Output	L.F.	H.F.	
1	Time track					
2	H.S.J. well geophone	30	30	cut	92	off
3	H.S.J. well geophone	40			48	
4	H.S.J. well geophone	30			92	
5	H.S.J. well geophone	48	30			
6	H.S.J. well geophone	30	30			off
7	H.S.J. well geophone	48	30			on
8	Reference	30				off
9	2	30				
10	3	30				
11	5	30	30	cut	92	off



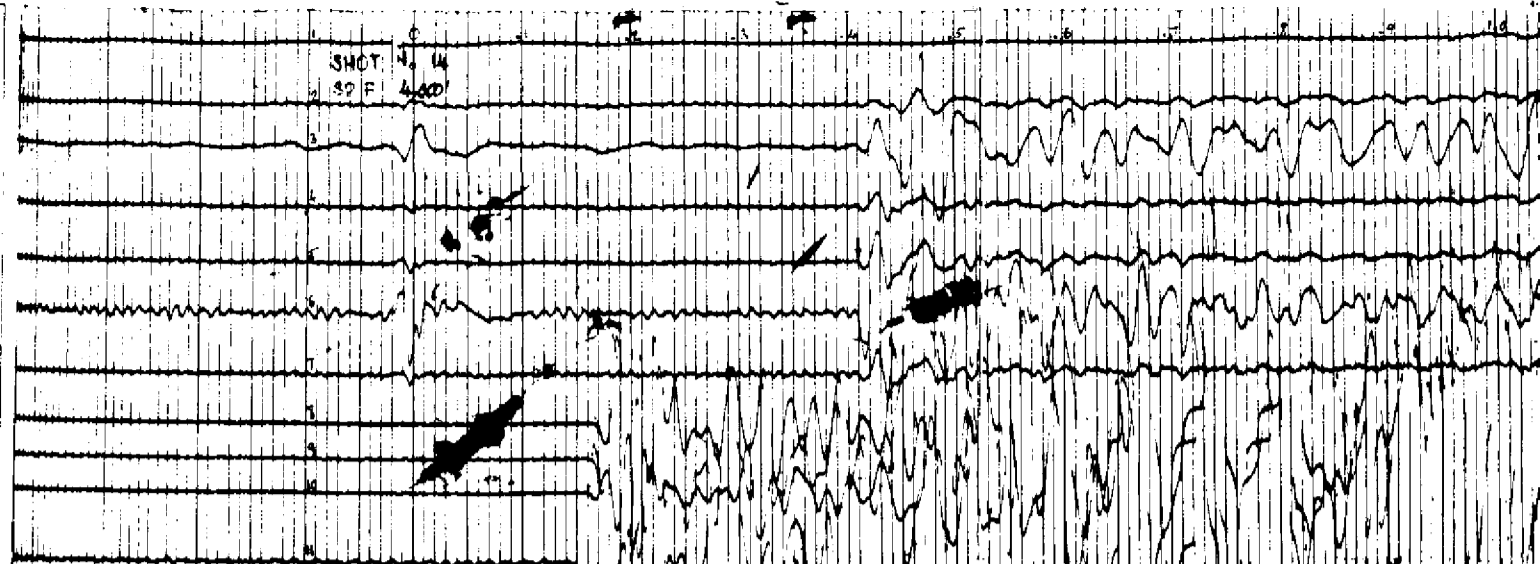
Client A.A.P.
Well KULSMILL 2

CGG PARTY X 6526

Date D 4 M 8 Y 66
Hour H 11 M 58 am
No of Shot 16
Shot Point P
Shot Point to well distance in feet 1007
Depth of charge in feet SURFACE
Charge in lbs 800 - 4 DETON
Perturbations
Observations

Depth of well geophone in feet below KB 4000
Down Up
Well geophone GULF
Pressure geophone G.C.E.10
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P11 S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A G C
		Input	Output	LF	HF	
1	Time break					
2	Ball well geophone	30	50	cut	92	off
3	Gulf well geophone	40	-	-	48	-
4	H.S.J. well geophone	38	-	-	98	-
5	H.S.J. well geophone	48	30	-	-	-
6	H.S.J. well geophone	60	60	-	-	off
7	H.S.J. well geophone	50	50	-	-	on
8	Reference 1	30	-	-	-	off
9	2	30	-	-	-	-
10	3	30	-	-	-	-
11	5	30	50	cut	92	off



Client A.A.P.
Well KULSMILL 2

CGG PARTY X 6526

Date D 4 M 8 Y 66
Hour H 11 M 10 am
No of Shot 15
Shot Point C
Shot Point to well distance in feet 656
Depth of charge in feet SURFACE
Charge in lbs 125 - 3 DETON
Perturbations
Observations

Depth of well geophone in feet below KB 3300
Down Up
Well geophone GULF
Pressure geophone G.C.E.10
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P11 S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A G C
		Input	Output	LF	HF	
1	Time break					
2	Ball well geophone	30	50	cut	92	off
3	Gulf well geophone	40	-	-	48	-
4	H.S.J. well geophone	38	-	-	98	-
5	H.S.J. well geophone	48	30	-	-	-
6	H.S.J. well geophone	60	60	-	-	off
7	H.S.J. well geophone	50	50	-	-	on
8	Reference 1	30	-	-	-	off
9	2	30	-	-	-	-
10	3	30	-	-	-	-
11	5	30	50	cut	92	off



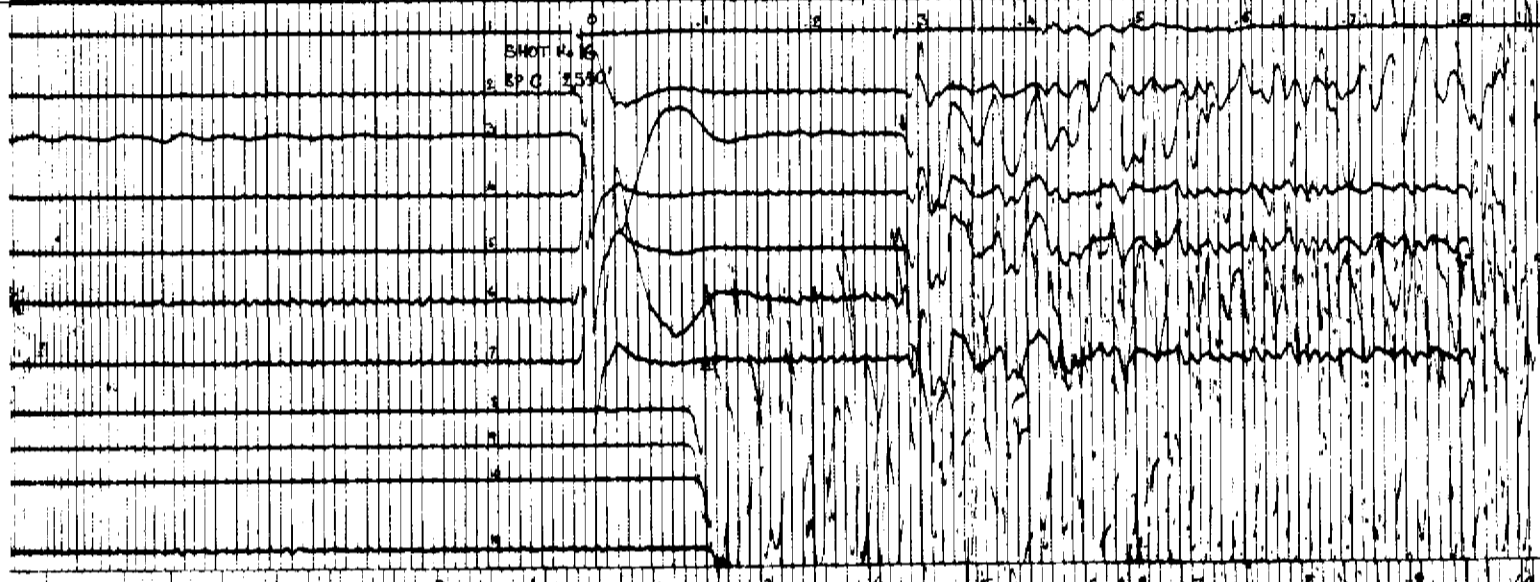
Client A.A.P.
Well KULSMILL 2

CGG PARTY X 6526

Date D 4 M 8 Y 66
Hour H 11 M 30 pm
No of Shot 18
Shot Point C
Shot Point to well distance in feet 656
Depth of charge in feet SURFACE
Charge in lbs 75 - 2 DETON
Perturbations
Observations

Depth of well geophone in feet below KB 2850
Down Up
Well geophone GULF
Pressure geophone G.C.E.10
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P11 S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A G C
		Input	Output	LF	HF	
1	Time break					
2	Ball well geophone	30	50	cut	92	off
3	Gulf well geophone	40	-	-	48	-
4	H.S.J. well geophone	38	-	-	98	-
5	H.S.J. well geophone	48	30	-	-	-
6	H.S.J. well geophone	60	60	-	-	off
7	H.S.J. well geophone	50	50	-	-	on
8	Reference 1	30	-	-	-	off
9	2	30	-	-	-	-
10	3	30	-	-	-	-
11	5	30	50	cut	92	off



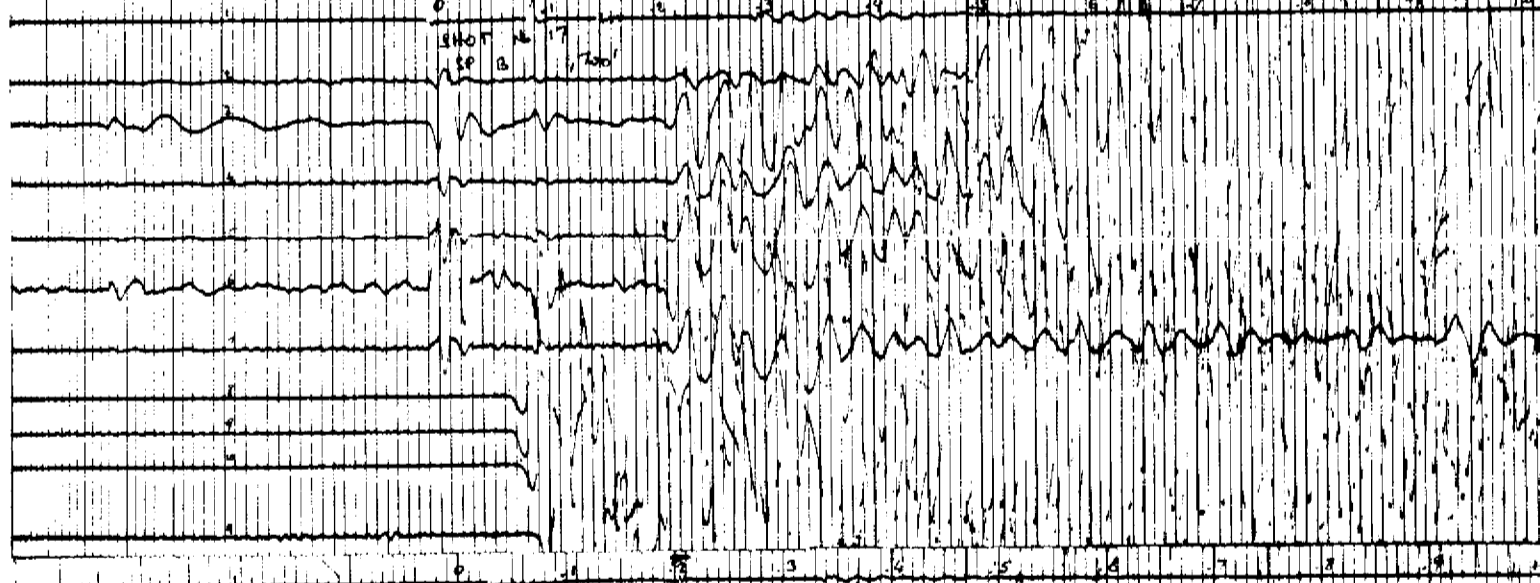
Client A.A.P.
Well KULSMILL 2

CGG PARTY X 6526

Date D 4 M 8 Y 66
Hour H 11 M 40 pm
No of Shot 17
Shot Point B
Shot Point to well distance in feet 485
Depth of charge in feet SURFACE
Charge in lbs 84 - 1 DETON
Perturbations
Observations

Depth of well geophone in feet below KB 1700
Down Up
Well geophone GULF
Pressure geophone G.C.E.10
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P11 S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A G C
		Input	Output	LF	HF	
1	Time break					
2	Ball well geophone	30	50	cut	92	off
3	Gulf well geophone	40	-	-	48	-
4	H.S.J. well geophone	36	-	-	98	-
5	H.S.J. well geophone	48	30	-	-	-
6	H.S.J. well geophone	60	60	-	-	off
7	H.S.J. well geophone	50	50	-	-	on
8	Reference 1	30	-	-	-	off
9	2	30	-	-	-	-
10	3	30	-	-	-	-
11	5	30	50	cut	92	off



Client A.A.P.
Well KULSMILL 2

CGG PARTY X 6526

Date D 4 M 8 Y 66
Hour H 11 M 59 pm
No of Shot 18
Shot Point B
Shot Point to well distance in feet 485
Depth of charge in feet SURFACE
Charge in lbs 10 - 1 DETON
Perturbations
Observations

Depth of well geophone in feet below KB 800
Down Up
Well geophone GULF
Pressure geophone G.C.E.10
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P11 S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A G C
		Input	Output	LF	HF	
1	Time break					
2	Ball well geophone	30	50	cut	92	off
3	Gulf well geophone	40	-	-	48	-
4	H.S.J. well geophone	38	-	-	98	-
5	H.S.J. well geophone	48	30	-	-	-
6	H.S.J. well geophone	60	60	-	-	off
7	H.S.J. well geophone	45	50	-	-	on
8	Reference 1	30	-	-	-	off
9	2	30	-	-	-	-
10	3	30	-	-	-	-
11	5	30	50	cut	92	off



Client A.A.P.
Well KULSMILL 2

CGG PARTY X 6526

Date D 4 M 8 Y 66
Hour H 11 M 10 pm
No of Shot 19 WZ
Shot Point A
Shot Point to well distance in feet 145
Depth of charge in feet SURFACE
Charge in lbs 3 - 10 DETON
Perturbations
Observations SHOTS CARRIED OUT FROM WZ SURFACE - AIRBORNE ONLY

Depth of well geophone in feet below KB 900
Down Up
Well geophones GULF G.C.E.10
Pressure GULF G.C.E.10
HALL SEARS H.S.J.
Ref geophones HALL SEARS
Equipment S.I.E
Amplifiers P11 S.I.E
Camera PRO II S.I.E

No of Trace	DESIGNATION	GAIN		FILTER		A G C
		Input	Output	LF	HF	
1	Time break					
2						
3						
4						
5						
6						
7						
8						
9	Reference 1	30	30	cut	92	off
10	2	30	-	-	-	-
11	3	30	-	-	-	-
12	4	30	50	cut	92	off

