BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

Record 1987/16

SERCEL SN368 Equipment Tests

Millmerran, Queensland, 1986

Operational Report

by

D.W. Johnstone, M.J. Sexton and F.J. Taylor

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1 ABSTRACT

The Bureau of Mineral Resources conducted equipment tests at Millmerran,QLD. using the newly acquired Sercel SN368 data acquisition seismic system. The equipment operated satisfactorily and proved to be versatile. The operation of the equipment is quite complex and will require a degree of dedication from future operators and technical personnel. Shot firing by radio is not possible with the existing radios because of interference from the central units in the recording cab. The system requires a relatively low-voltage blaster in order to avoid cross-feed into the line cables. Existing BMR blasters were not satisfactory. Care is required in deploying remote field units and cables. The time required for two persons to pick up or lay out 90 station units and cables is approximately 90 minutes. Recommendations are given for daily tests, the deployment of individual units of the system and modifications to the existing geophone carriers.

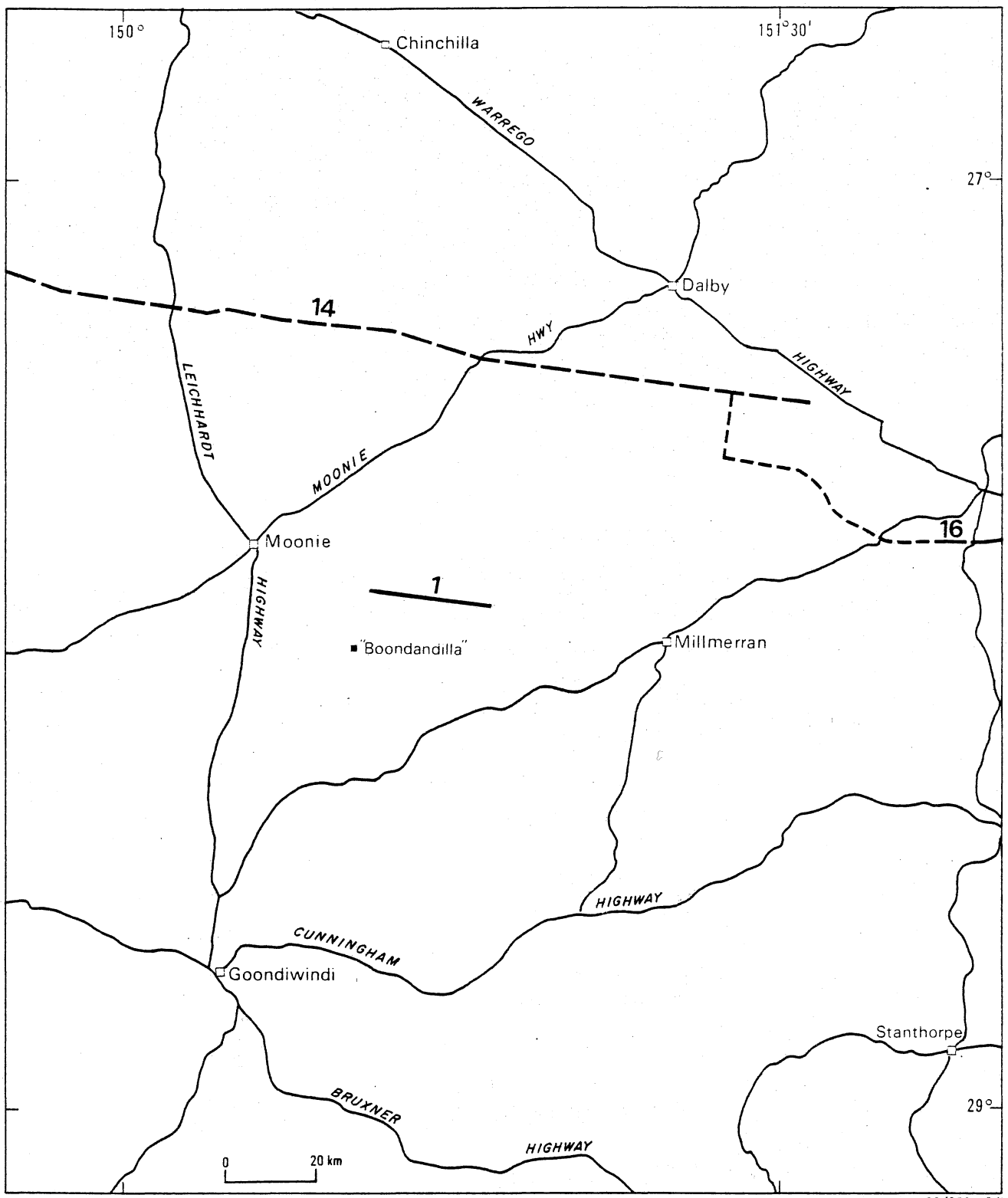
2 INTRODUCTION

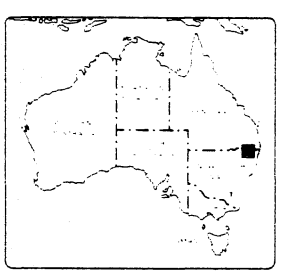
The Bureau of Mineral Resources purchased a new seismic data acquisition system during 1985-86. The system (SERCEL SN368) is a telemetry system and was completely new to all personnel in the seismic section. Following a short course on the system and the installation of the equipment in vehicles a short test survey was conducted at Millmerran in Queensland during May and June 1986 (Fig 1). The objective of this survey was to test the equipment, determine modes of operation, allow personnel to become familiar with the system, recommend changes to anciliary equipment if necessary and to acquire sufficient data for testing the BMR Disco SEG-D processing routines. For operational simplicity the survey area was chosen close to Brisbane where assistance could be provided by Seismic Supply and where a known thickness of sediment existed.

This report describes the results of the survey and gives recommendations for modes of operation on future surveys.

3 EQUIPMENT

A detailed list of the Sercel SN368 seismic data acquisition system (as at June, 1986) is given in Appendix 1. The classification of this equipment as defined by the Stores Section of the Dept. of Resources and Energy is given in Appendix 5. Figure 2 is a block diagram of the Master Control Unit (MCU). Figure 3 illustrates the line layout and defines some of the terms used by Sercel. This configuration is a 2-D version



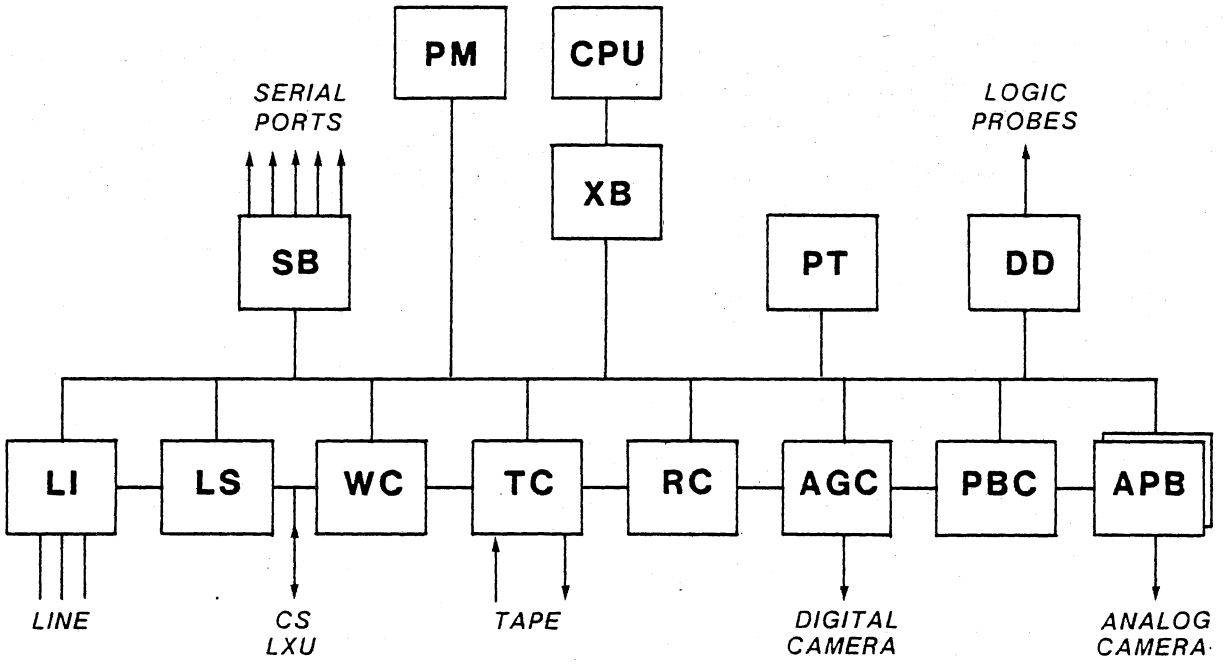


1986 SN 368 equipment test survey

1984 SE Queensland seismic survey

1986 Proposed traverse

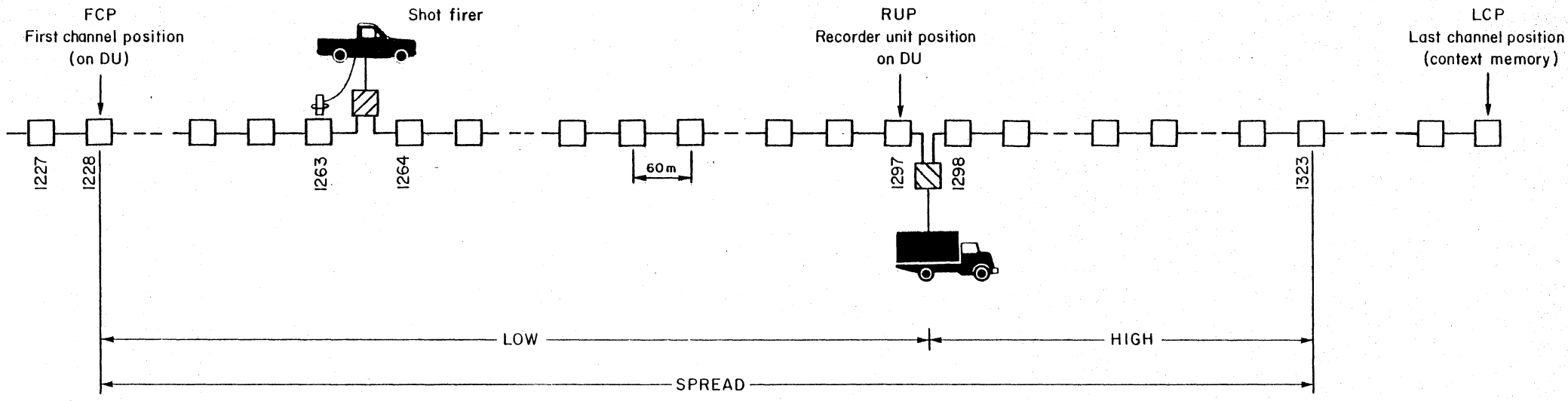
Fig. 1 Location map



LI - *Line input*
LS - *Line sort*
WC - *Write controller*
TC - *Tape controller*
RC - *Read controller*
AGC - *Automatic gain control*
PBC - *Play back controller*
APB - *Play back amplifier*
SB - *Serial board*
PT - *Programmable time*
DD - *Data dump*
PM - *Program memory*
CPU - *Central processor unit*
XB - *Extension board*

Fig. 2 SN 368 MCU block diagram

26/G56-13/5



Station unit (SU)

Tb/Uh unit (Tb/Uh)

Cross station unit (CSU, inside cab)

This example.
Shot at station 1263
Trace 1 is at 1228
Trace 96 is at 1323
No gap
(Recording parameters for this shot see description of context memory)

Fig. 3 Typical reflection spread

26/G56 - 13/3

of that supplied by Sercel and is preferred for simplicity. Station numbers are given to illustrate, by way of an example, the contents of the Context Memory and the coding on the monitor record. See Fig's 4 and 5 for monitor record display.

4 GEOLOGY

The survey area lies in the eastern part of the Surat Basin. The geology of this Jurassic-Cretaceous basin is discussed in detail by Exon (1976). The Chinchilla-Goondiwindi slope, over which the traverse lies, is the most eastern structural unit identified in the Surat Basin. This westerly dipping feature is flanked by the pre-Jurassic Kumbarilla Ridge to the east and the Goondiwindi-Moonie fault to the west.

The Chinchilla-Goondiwindi slope contains sediments of Cretaceous to Jurassic age. To the west of the Goondiwindi-Moonie fault, the sediments of the Bowen Basin sequence (early Permian to Triassic) underly the Surat Basin. Whereas to the west of this fault only remnants of the Bowen Basin remain. Figure 6 shows the location of the seismic line and how it relates to the structural units.

5 FIELD OPERATIONS

LOCATION. The survey was located along an "east-west" track in the Boondandilla State Forest (Fig.1). This line was previously shot in the early 1960's with single fold techniques. Parts of it were again shot in 1982 using modern techniques. In

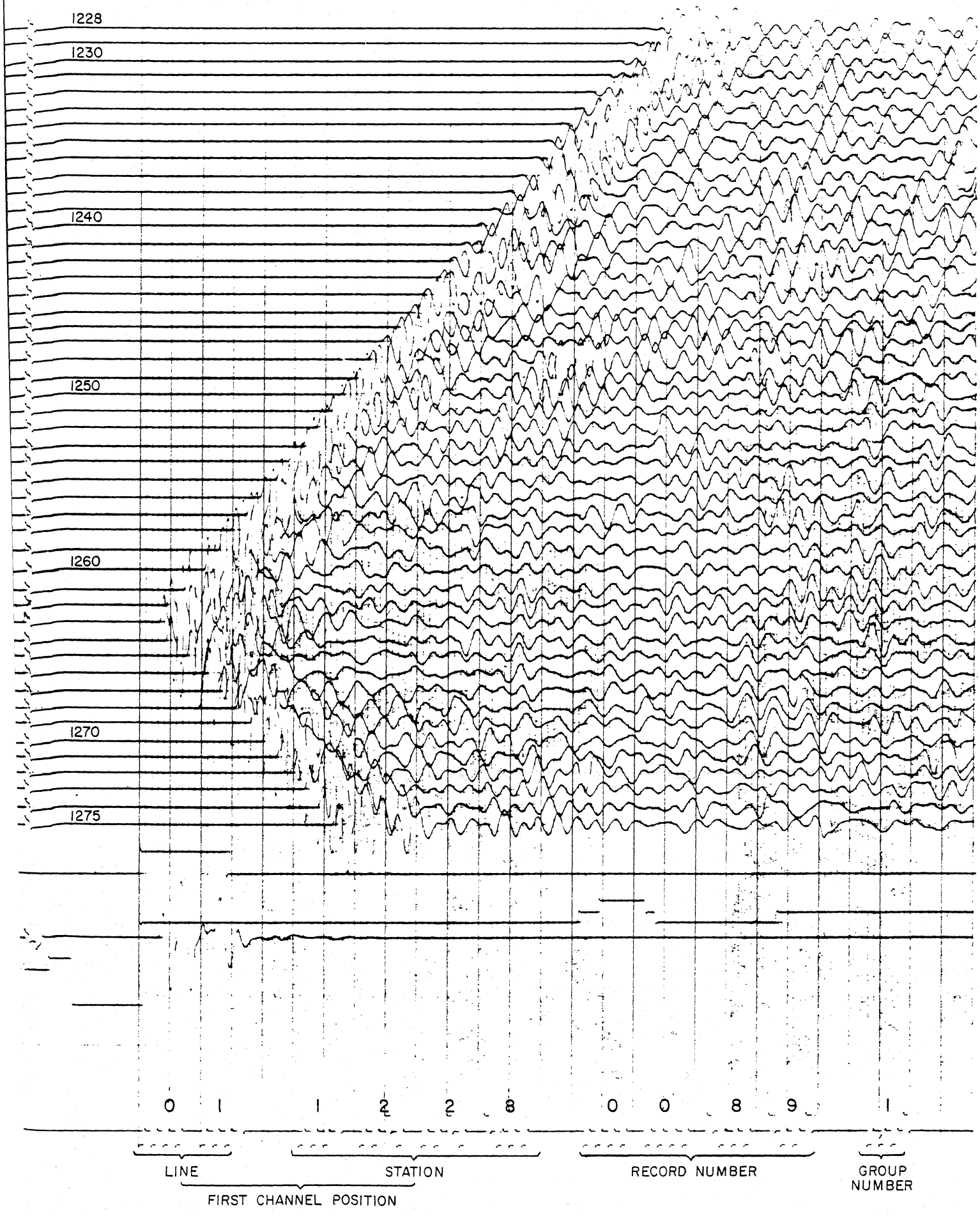


Fig.4 Monitor record group 1

26/G56-13/7

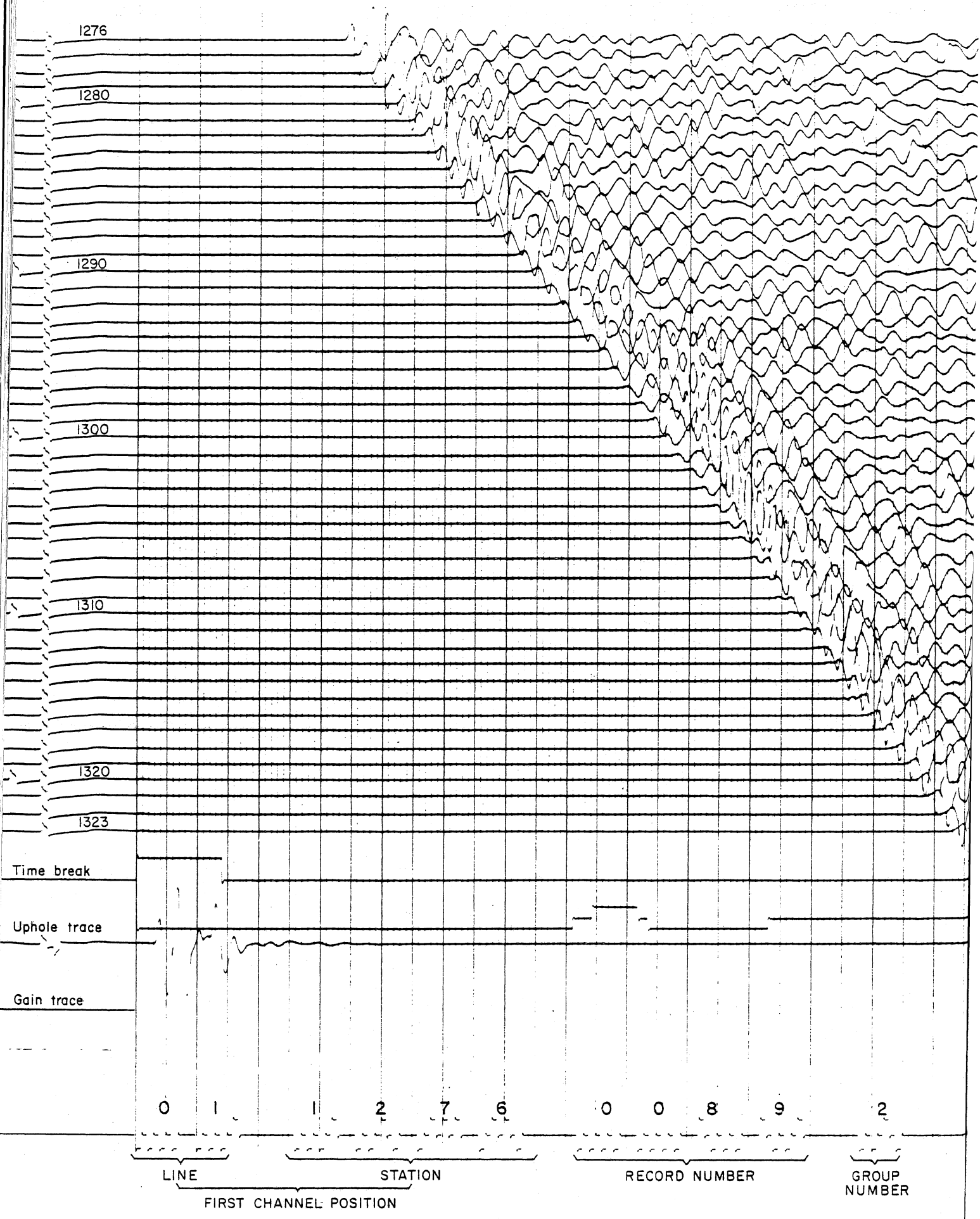


Fig.5 Monitor record group 2

26/G56 - 13/8

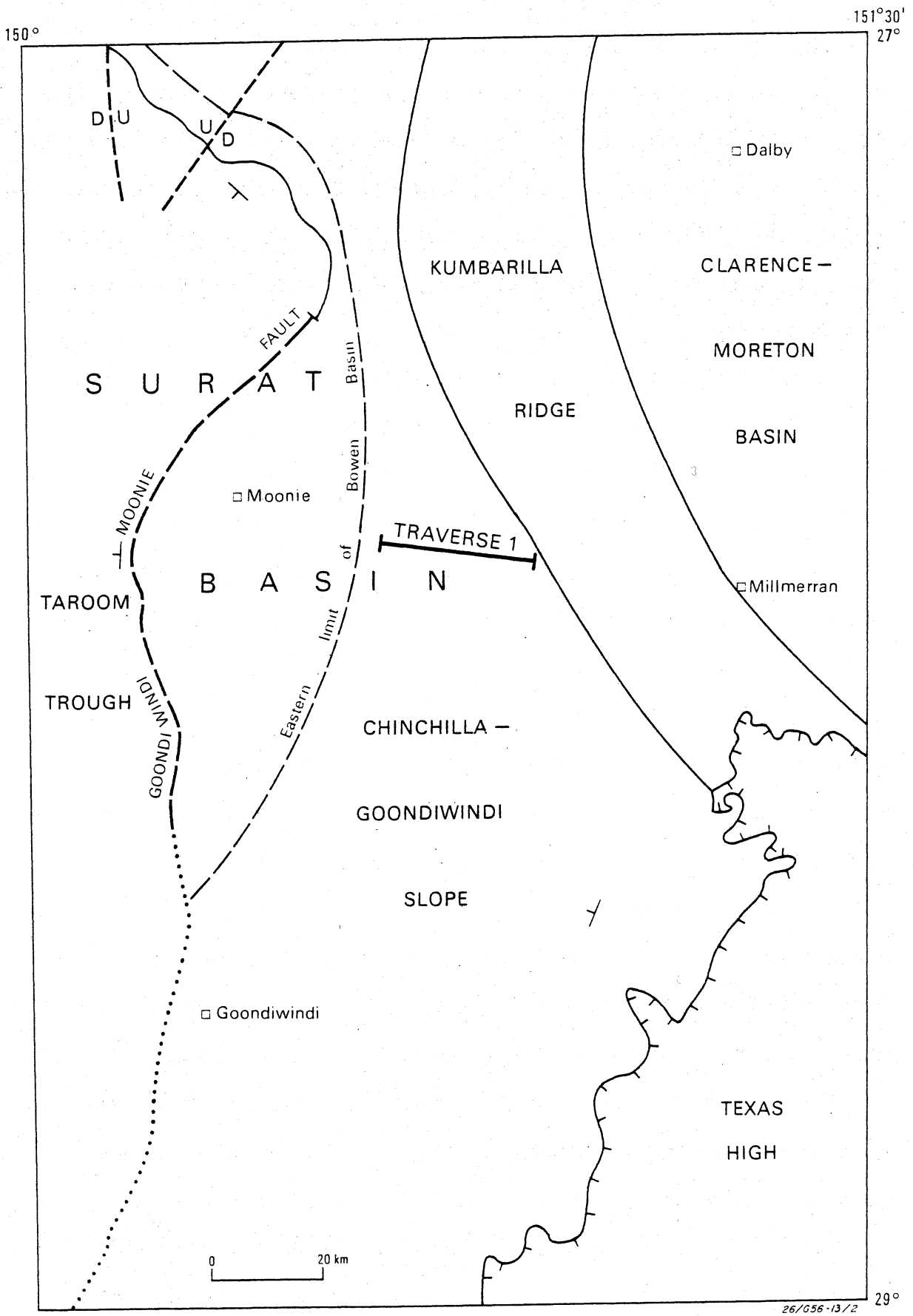


Fig.6 Geological setting

addition this line was tied to the Tinker Creek exploration well (1982) using a north-south cross line.

SURVEYING. Surveying was done by the Queensland Branch of the Australian Survey Office. The traverse line was pegged at 60 metre station interval with station numbers extending from 1000 to 1443. The Australian Survey Office provided Australian Map Grid (AMG) co-ordinates for bend-points and end-points as well as elevations referenced to the Australian Height Datum (AHD). AMG co-ordinates and elevations are given in Tables 2 and 3 respectively.

DRILLING and EXPLOSIVES. One Mayhew drilling rig was used on the survey. Shot holes were drilled to 40 metres and a charge size of 8 kg. was used for all shots. Drilling involved both air drilling as well as water injection. The two uphole shoots shown in Figures 7 and 8 indicate that this shooting depth was well below the depth of weathering. The normal explosives used on the survey was Anzite Blue. However the party did compare three charges of Dupont's Tovex SDX explosives with the Anzite Blue. Power spectrums of equivalent traces from each type of explosive were compared. There are no readily descernible differences in the end result of the two type of explosives.

RECORDING. Geophone groups consisted of 16 GSC20D geophones spaced at 4 metres with a group spacing of 60 metres. The shot interval along the line was on average every 5 stations. A total of 27 km. of line involving 100 shots was recorded. The initial 70 shots were recorded in PE 1600BPI format and the final 30 shots were recorded in GCR 6250BPI format. Two uphole shoots were recorded on a separate tape in GCR 6250BPI format. Recording parameters were set for 96 channel, 2ms sampling and 6 sec recording time. The number of channels recorded on any

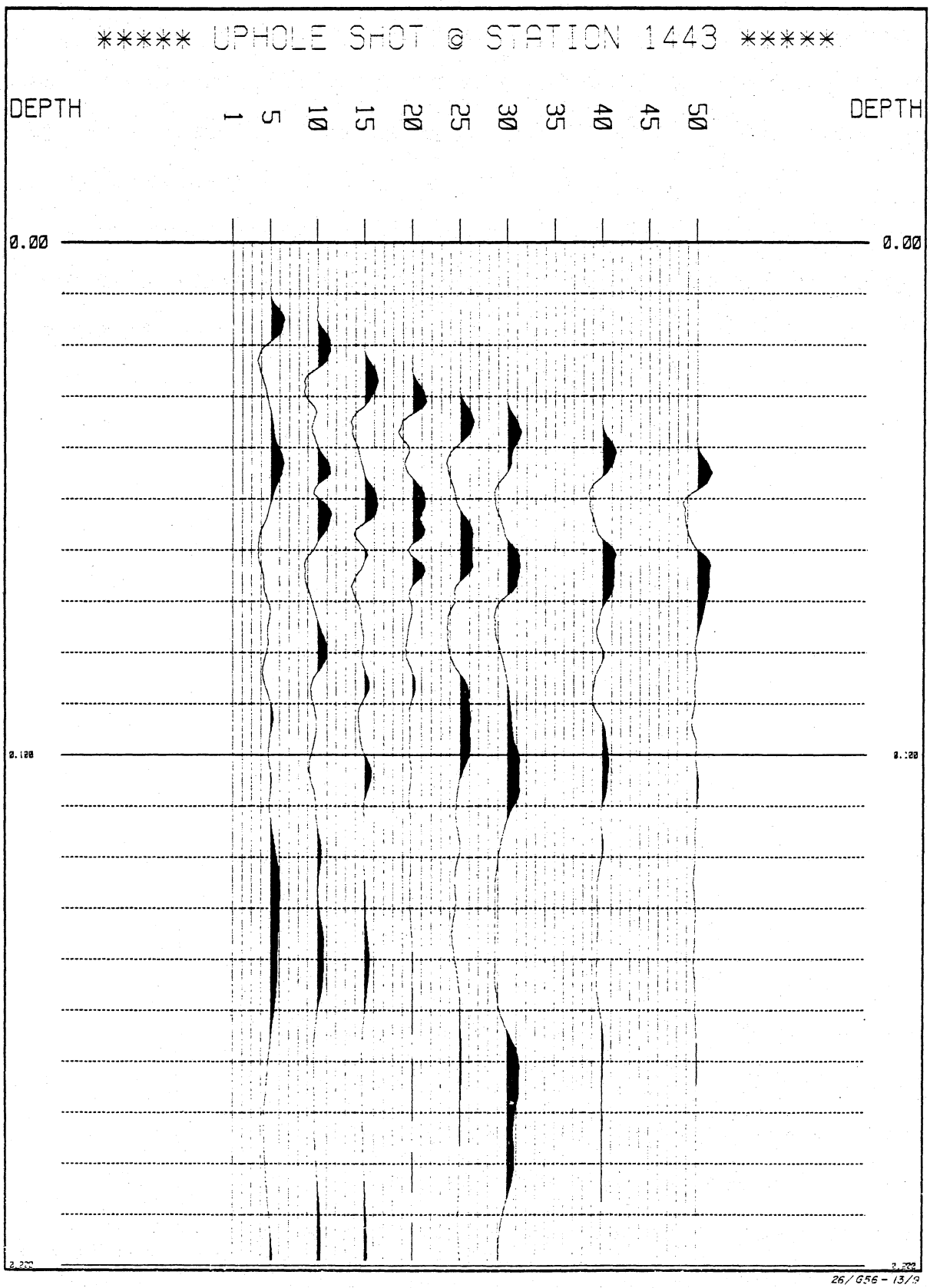


Fig.7 Uphole shot station 1443

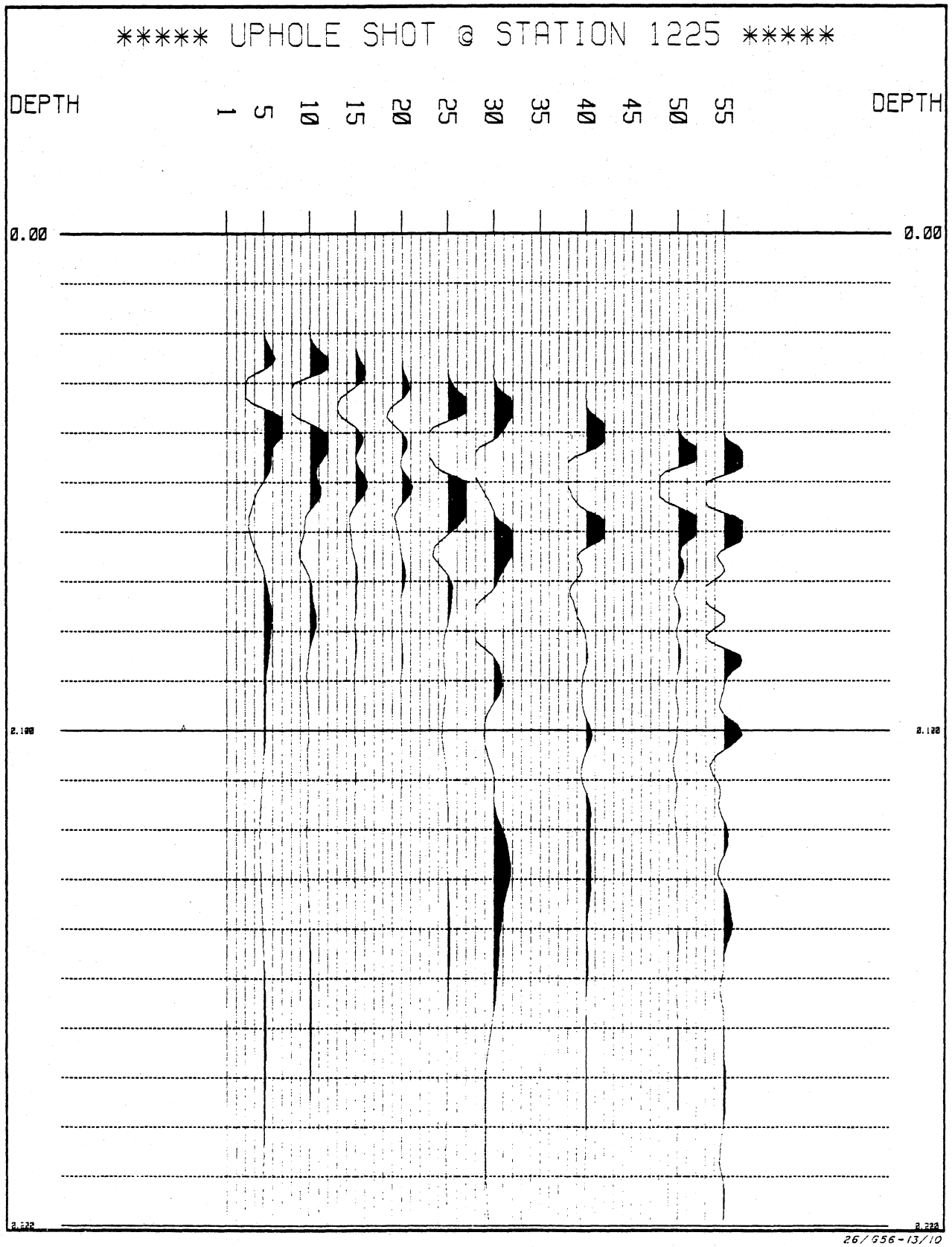


Fig.8 Uphole shot station 1225

shot varied continuously along the line with the minimum number accepted being 72 and the maximun 96. This mode of operation was a compromise between obtaining a maximum amount of data and efficiency of operation. The delay between actual time-break and the trace break recorded on camera and magnetic tape was measured using a detonator. This delay is less than 2 ms and hence can be ignored in future.

A description of the abbreviations normally used for the units of the SN368 and how these units are deployed in the field is given below.

MCU	Master Control Unit
CSU	Cross Station Unit
SU	Station Unit
PSU	Line Power Supply Unit
TB-UH	Time Break-Uphole Unit

UNIT	DEPLOYMENT
MCU and CSU	Recording Cab.(Fixed mounting)
PSU	These are stationed on the ground at every 40 station units and are moved when adjacent geophone sets and station units are lifted for normal transport to the front of the line. Power for the units is supplied by a 12v car battery which is placed on the ground beside the unit. No power is consumed by a PSU until the line is activated by the MCU. It is expected that a fully charged battery will last 3 days before recharging is necessary. Low or faulty power on the line is signalled by beeps or continuous beeping. This audible signal can be

heard using the telephone handset plugged into any of the line units.

TB-UH — This unit is permanently carried on the shooting truck and is plugged into the line wherever a shot is required. The shooter arms the blaster and advises the observer. The SN368 then fires the shot. The installation of the shot-firers equipment must be installed on the rear of the vehicle on the drivers side.(THIS IS EXTREMELY IMPORTANT)

SU — These are installed at each geophone station and are transported in special boxes on the jugwagons.

CABLES — The individual 65m cables are tied together with rope or with their own cable. (NOT WITH THEIR DUST COVERS). The cables are then deployed in much the same manner as in the old DVSIV system.

The shortest time interval between shots on the Millmerran survey was 7 minutes. This is about the same time required to pick up 5 to 6 station units, cable and geophones using two vehicles with two persons in each vehicle. THE RESULT OF THIS TIMING CHECK IS THAT TWO PERSONS WOULD TAKE 120 MINUTES TO PICK UP 90 STATION UNITS AND CABLES. IT WOULD TAKE SLIGHTLY LONGER TO LAY DOWN THE SAME AMOUNT. The deployment of station units and cables would be slightly more efficient when these items are layed out on the driver's side of the traverse. The work involved with cables and station units is not strenuous but it is time consuming because of the stop-start situation at each geophone station. The costs of the station units and cables demands that such items of equipment must be picked up at night in any area of high

population density. In order to make such field procedures practical it is important that four geophonne carriers be used on future surveys. The new Sercel cable is much lighter than that used with the DFSIV 48 channel equipment and will not require 30 cwt vehicles for transport. It has been determined that Toyota flat tray diesel utilities will be suitable as geophone carriers provided four units are available.

SOFTWARE. Software modules 210, 211 and 212 which test equipment performance were run at Millmerran and the results stored on magnetic tape. The following is a list of software modes which were tried on the survey. Some of these modules are used frequently every day.

MODE	FUNCTION
000	Automatic test mode. This routine is automatically scheduled on power up.
001	Edit of the context memory. This is used to set the contents of memory at the beginning of a survey. Once initial parameters are set then this mode should not be used again.
004	Prints contents of context memory. This would only be used for permanent recording of all the data and parameters set for a survey. Otherwise it is rarely used.
005 and 006	Used to light up or turn off DU. Not used for normal work.
008 and 009	Used to display time or alter time. It's only use is to set time if it has changed by an unacceptable amount.
100	Forming the line. This mode requires at least one SU connected to the CSU. This mode is

always used prior to recording a shot.

105 and 106 Line power on or off. These modes are only used to check which is the high or low side on the CSU.

110 and 111 These modes find the last SU on either the low or high side. They are used extensively to check the integrity of the line in the morning and when new station units are added to the front of the line. Mode 111 is used to look ahead at the high end of the line to check new connections and geophone plants. The second stage of these modes check the pulse test against values stored in memory.

112 and 113 Displays geophone pulse tests on the camera. This is a quick method of checking geophone connections. Those geophones which are not connected do not give the obvious display.

200 Seismonitor mode. This mode samples the geophones continuously and displays the result on the camera. The program can be used to check goephone noise. This program is automatically scheduled during the data acquisition mode.

201 Data acquisition mode. This program is the one used to acquire data from all shots. It is normally used in a chaining mode with mode 100 and is scheduled in the HALT state so that the shot point information can be entered and recorded on tape. Tape by-pass may be used with this mode if for example a test detonator is being fired and tape recording is not desired.

210 Instrument noise to tape. MONTHLY TEST.

211 Pulse test on resistor to tape. MONTHLY TEST.

212 Pulse test on geophone to tape. MONTHLY TEST.

220 Record sine wave, 3.9 Hz, 7 V. This oscillator test is probably not essential because of the low frequency.

221 Record sine wave, 31.2 Hz, 7 V.

222 Record sine wave, 31.2 Hz, 22.6 uV.

223 Record sine wave, 31.2 Hz, 181 uV. Modes 221 to 223 are all suitable for the daily oscillator test.

260 Burst record. This program records an ID BURST at the BOT marker of a new tape. The program is essential when a new tape is installed. Also this program can be used in tape by-pass mode if the load key was accidentally pressed while using a tape previously initialised with a burst. The burst is an ID on the magnetic tape which allows other tape transports to identify the format used for recording. The LOAD key signals to the computer that a tape has just been loaded and whenever a program requiring tape recording is run then the program expects to find an ID burst.

261 EOF record on tape. This program should be run when no more records are to be added to a tape. It is automatically run when the tape detects the LOW TAPE indicator. The EOF led is set when this occurs and the operator must check for this

light when the tape supply is low. The automatic recording of an EOF will not prevent additional records from being recorded on tape.

270 Galvanometer adjustment. This program is not required with the existing camera. It is used to balance individual galvanometer response.

280 Operator report heading. It is not required. The use of the line printer to produce an observers log is not very practical because of the continuous use of the printer for diagnostics. The program together with playback modes and print modes would be useful to produce a tape log on a Saturday.

300 Pulse test on resistor. Faults displayed on the DU.

301 Pulse test on resistor. Print faults.

302 Pulse test on resistor. Display results.

303 Pulse test on resistor. Print results.

310 Pulse test on geophone. Geophone response is checked against that stored in context memory and if it does not agree to within a certain percentage then the level and percentage is displayed on the DU. The percentage determined at Millmerran was 8%. However on windy days it is common for several sets of geophones to exceed this percentage. It is the observers responsibility to decide whether such units are to be checked or accepted. This program does have an inherent problem when checking one of the outer geophone groups. All groups before

this one must be checked before hand. This problem would be alleviated if a 9600 baud VDU was used to dump results from the pulse test instead of a relatively slow printer.

311 Pulse test on geophone. Print faults. Both modes 310 and 311 are used extensively throughout the day.

312 Pulse test on geophone. Display results on the DU.

313 Pulse test on geophone. Print results.

314 Store geophone test in context memory. This program was run at Millmerran in May 1986 using 96 station units and geophone groups. It should not be used again unless the battery supply to the context memory has died. If such is the case then these values may be returned to memory by running the program again or by storing the values shown in Table 1, Zone 4 into context memory using mode 001. Note that it requires at least 4 hours to set up a line specifically to run this mode. Fig. 9 is a pictorial representation of the response of the geophone to the pulse test.

320 Station Unit noise and offset test. This program will check the noise and offset level from all station units and display faulty ones on the DU.

321 SU noise and offset test. Print faults. This is a check of station units and should be run whenever units are suspect.

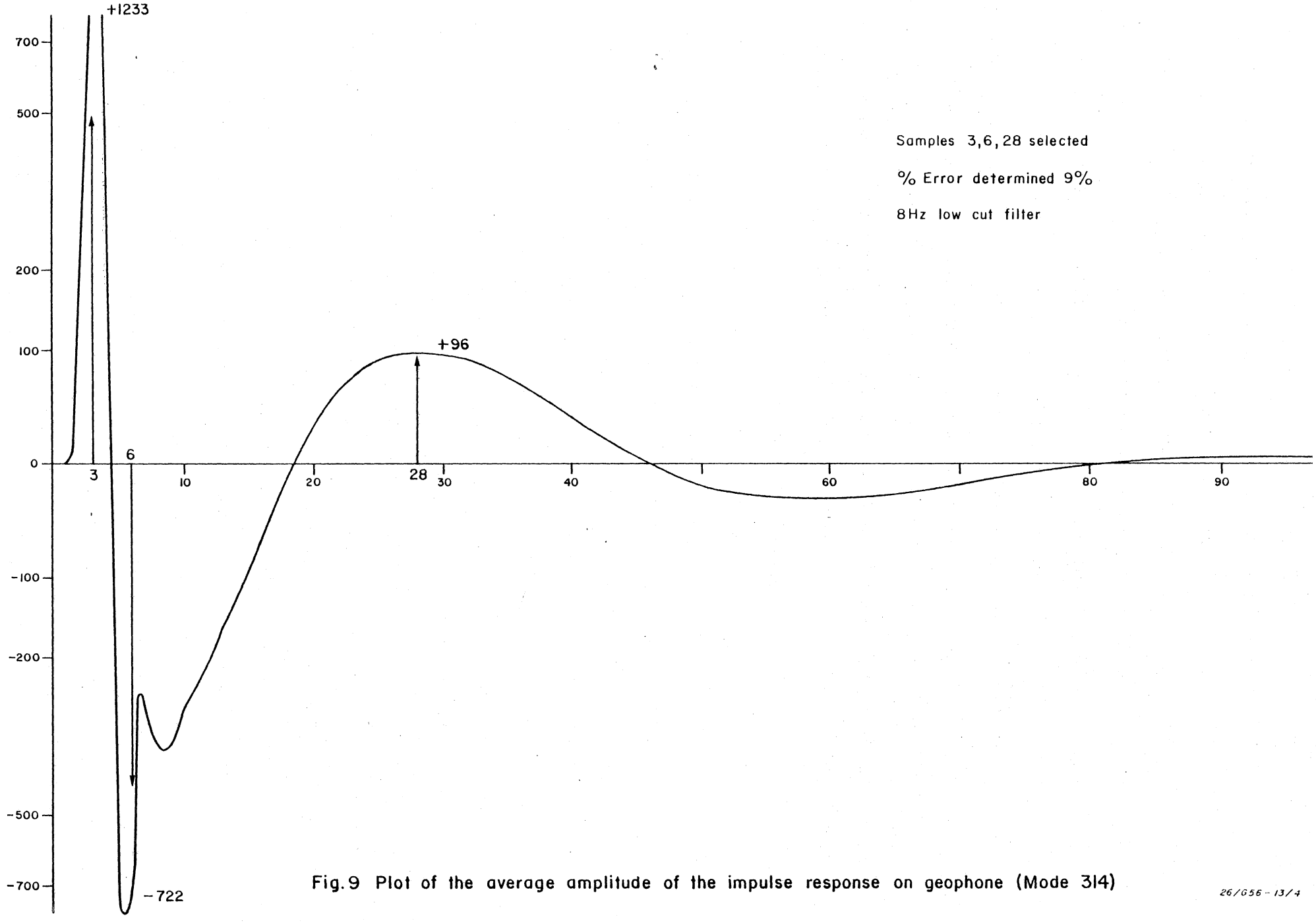


Fig. 9 Plot of the average amplitude of the impulse response on geophone (Mode 314)

26/G56-13/4

322 SU noise and offset test. Display results.

323 SU noise and offset test. Print faults.

380 Print test header. Not used.

400 Magnetic tape, search forward.

401 Magnetic tape, search back. This can be used to rewind to the BOT by specifing a very large file number.

402 Magnetic tape, automatic search.

403 Magnetic tape, playback last record. This program is currently always used in conjunction with the block number set on the DU. It will not be required as frequently when a 96 channel camera becomes available.

404 Magnetic tape, playback first record encountered.

405 Magnetic tape, continuous playback. This program is of only limited use.

410 Magnetic tape, return into the gap following the last record. This program will have to be used if the LOAD button was accidentally pressed and the tape moved forward looking for a tape burst.

411 Magnetic tape, return to gap preceding last record. This program is rarely used.

412 Magnetic tape, Erase last record. This program is best left alone as the potential for error is great.

Problems encountered with the software included the following.

1. RSI Address 118 in context memory does not work unless the INCREMENT is set to a negative number.

2. Chaining mode will loop on request for a second identical mode.

e.g. 3220
A403
A221
A403
A222
A403

This sequence will continually loop on the call to "A221"

3. With PBGN set to 2 in context memory the camera delay-off set in context memory is ignored and a longer paper feed at the end of the record is given when running a playback mode (e.g. 403).

4. The Observer's report to the printer is not very practical. When the Observer's report header is written, the ORGE flag in context memory is reset. This causes the observers report not to print time. The ORGE flag in context memory must be set to correct this situation.

5. When the power to the printer is turned off a new page feed command is automatically sent to the printer.

6. On two occasions the magnetic tape refused to record and the error code stated that a tape burst could not be found. This

error is suspected to be the result of an unintentional press of the load button. The solution to the problem is to position the tape using mode 410 and then run mode 260 in tape by-pass mode. The tape should now be ready for the next recording.

7. Trouble was experienced with mode 401 when the tape was positioned close to the EOT marker. The program found the EOT marker and stopped. Program 402 was used instead and worked well.

HARDWARE. Difficulties experienced with hardware were confined almost entirely to anciliary equipment. These problems arose because of ignorance of the system requirements and ignorance of mode of operation. Specific hardware problems and general comments on hardware are given below.

1. Tape Transport. A faulty IC was replaced during the change-over from PE format to GCR format. The tape transport has been calibrated to use only "CONTROL DATA Storage Master" 1200 ft tapes and only this brand of tape should be used.

2. Blasters. The INPUT/OUTPUT blaster normally used with the DFSIV system was not suitable for line shooting with the SN368 system. This blaster operates at 800v and produces cross-feed in the Sercel cable as well as the uphole circuit. Currently this blaster does not work for radio shooting off the end of the line and the problem will have to solved before long off-set shooting is possible. The BC8A blasters can be made to work on the line and the output voltage (450v) does not produce cross-feed. However these blasters are close to 20 years old and most of the electronic components have aged. Hence their reliability is

questionable. The blaster which was used successfully on the survey was an OYO blaster hired from Seismic Supply. This blaster operates at 150v and does not produce cross-feed. Two of these units have been recommended for purchase since the completion of this survey.

3. Radios. The radios used on the line for communication between the observer and line crew suffer from interference transmitted by the Sercel cable as well as the electronics in the recording truck. The Sercel cable conducts a 4 MHz signal during line operations. The effect of this transmission is that the line crew, sitting in vehicles on the line, cannot hear any transmission from the recording cab when the line is active. This does not occur at every location on the line and at the moment the phenomena is not fully understood. The radio interference inherent in the recording cab can be severe and may pose a major problem to radio shooting in future.

4. Geophone Racks. The geophone racks on the jugwagons must be modified to prevent the thin cable from snagging at the bottom of the bin.

5. Test Geophones. The most common practice of testing a suspected combination of station unit and geophone set is to replace the geophone set. This function will be made more efficient if a single geophone, correctly damped, is installed in each line vehicle.

6. Reported Errors. Several errors were reported during the course of recording the 100 shots. All of these errors were

confined to the initial part of the survey and while the tape transport was in PE 1600 BPI mode. These errors are listed below.

SP 1043 line parity error.

SP 1154 tape parity error 2, syncro 1.

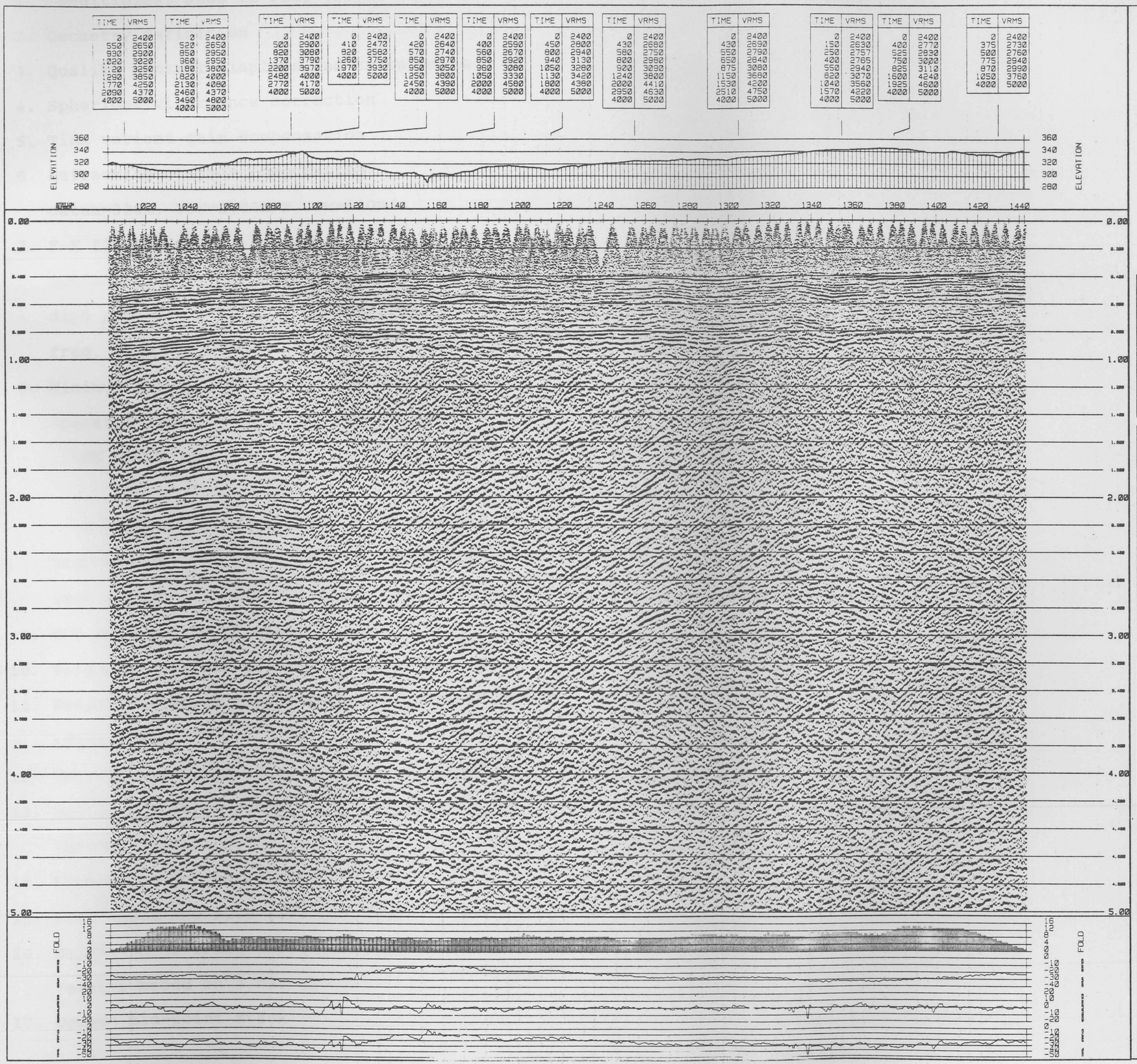
SP 1244 error 7A15 "13", start of scan error.

SP 1248 error 7A15 "13", start of scan error.

6 DATA PROCESSING

Data from the test survey has been processed at the BMR using the DISCO system. A final stack section is shown in Fig. 10. Full scale section (vertical scale, 10cm/s and horizontal scale, 9.84traces/cm) will be made available through the Copy Service, Australian Government Printer (Publications).

The most time consuming step in the data processing was the demultiplexing of the field data. DISCO at the BMR does not have the software to demultiplex SEGD (SERCEL format) data. The 1600 bpi, PE magnetic tapes were read and demultiplexed on the Field Processing System and data transferred to the DISCO in SEGY format. The 6250 bpi, GCR tapes were demultiplexed by contract (GSI, Sydney). A detailed step by step processing stream for the data is listed below.



BUREAU OF MINERAL RESOURCES

SURVEY : SN 368 EQUIPMENT TESTS 198
AREA : MILLMERRAN, QUEENSLAND

LINE : 1
STATIONS: 1000-1443

FINAL STACK

EAST

RECORDING PARAMETERS

SHOT BY	: BMR	DATE	: MAY - JUNE 1986
SYSTEM TYPE	: SERCEL SN368	SOURCE TYPE	: DYNAMITE
TAPE FORMAT	: SEGD	CHARGE	: 8.2 KG
DENSITY	: 1600BPI, PE OR	DEPTH	: 40M
	: 6250BPI, GCR		
RECORD LENGTH	: 6 SECONDS		
SAMPLE RATE	: 2 MSEC	SP INTERVAL	: 360M (AVE)
		SPREAD PATTERN	: VARIABLE
		NO OF CHANNELS	: 72 - 96
FILTERS	: LCF 8HZ, 18DB/OCT	MAX. OFFSETS	: 2160M - 5720M
	: HCF 178HZ, 72DB/OCT	GROUP PATTERN	: 16 IN-LINE, 4M SPACING
	: NOTCH OUT	GROUP INTERVAL	: 60M
		COVERAGE	: 1000%

PROCESSING SEQUENCE

[1] DEMULTIPLEX: SEGD TO SEGY(DISCO INTERNAL)

[2] GEOMETRY DEFINITION

[3] QUALITY CONTROL DISPLAYS AND TRACE EDITS

[4] SPHERICAL DIVERGENCE CORRECTION

[5] TIME VARIANT GAIN COMPENSATION

[6] REFRACTION STATICS COMPUTATION
DATUM 320M, VSW=2700M/S, VW=800M/S

[7] F-K FILTER:
OPERATOR LENGTH : 256 MS BY 7 TRACES
DIPS PASSED : -20 - +20 MS/TRACE
FREQ. PASSED : 15-150 HZ

[8] MINIMUM PHASE BANDPASS SPIKING DECONVOLUTION
OPERATOR LENGTH 256 MS

TIME GATES (MS)	PASSBAND (HERTZ)	WHITE NOISE OUT	WHITE NOISE IN
0 - 2000	15 - 100	5%	0.1%
2200 - 3200	15 - 100	5%	0.1%
3800 - 5000	15 - 100	5%	0.1%

[9] CDP SORT AND BRUTE STACK

[10] VELOCITY ANALYSES BEFORE RESIDUAL STATICS

[11] RESIDUAL STATICS COMPUTATION AND APPLICATION (1ST PASS)

[12] VELOCITY ANALYSES AFTER RESIDUAL STATICS

[13] RESIDUAL STATICS COMPUTATION AND APPLICATION (2ND PASS)

[14] NORMAL MOVEOUT CORRECTION

[15] POST-STACK NMO MUTE (20% STRETCH)

[16] BALANCING OF TRACE AMPLITUDES
(SCALAR BASED ON 3 SEC WINDOW)

[17] COMMON DEPTH POINT STACK

[18] BANDPASS FILTER

TIME (SEC)	BANDPASS (HZ)/SLOPE (DB/OCTAVE)
0.0	20/36 - 80/36
1.0	15/36 - 60/36
2.0	15/36 - 40/36
4.0	10/36 - 40/36

[19] TIME VARYING EQUALIZATION (GATE LENGTH 400MS)

[20] DISPLAY

PROCESSED BY:
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

CANBERRA, A.C.T.

QUALITY CONTROL CHECK

GEOPHYSICISTS : MIKE SEXTON
: DAVID JOHNSTONE

DATE : NOV 1986

HORIZONTAL SCALE: 30.99 TRACES/CM
189.8 TRACES/INCH
(1 CM = 1181.2 M)
(1 INCH = 3000.8 M)

VERTICAL SCALE : 9.335 CM/SEC
: 1.3135 IN/SEC

POLARITY : -VE ON TAPE = UPWARD GROUND DISPLACEMENT
= TROUGH
(I.E. NORMAL SEG CONVENTION)

Fig.10 Seismic section

1. Demultiplex: SEGD to SEGY (DISCO internal format)
2. Geometry definition
3. Quality control displays and trace edits
4. Spherical divergence correction
5. Time variant gain compensation
6. Refraction statics computation

   datum=320m, VSW=2700m/s, vw=600m/s
7. F-K filter:

   operator length = 256ms by 7 traces

   dips passed = -20 - +20 ms/trace

   freq. passed = 15 - 150 Hz
8. Minimum phase bandpass spiking deconvolution

   operator length = 256ms

TIME GATES (ms)	PASSBAND (HERTZ)	WHITE NOISE OUT	WHITE NOISE IN
0 - 2000	15 - 100	5%	0.1%
2200 - 3200	15 - 100	5%	0.1%
3800 - 5000	15 - 100	5%	0.1%

9. CDP sort and BRUTE stack
10. Velocity analysis before residual statics
11. Residual statics computation and application

    (first pass)
12. Velocity analysis after residual statics
13. Residual statics computation and application

    (second pass)
14. Normal moveout correction
15. Post stack NMO mute (20% stretch)
16. Balancing of trace amplitudes

    (scalar based on 3 sec window)
17. Common mid-point stack

18. Bandpass filter

TIME (sec)	BANDPASS Hz/ SLOPE (dB/octave)
0.0	20/36 - 80/36
1.0	15/36 - 60/36
2.0	15/36 - 40/36
4.0	10/36 - 40/36

19. Time variant equalisation (gate length = 400ms)

20. Display

7 RECOMMENDED PROCEDURES

The authors have endeavoured to set up a recommended set of procedures related to daily tests, routine operations and long term checks. These are not meant to be taken as absolute necessities and will undoubtedly be modified as more experience is obtained with the equipment.

DAILY TEST. The morning daily test should be one of modes 221, 222 or 223 with the record length set at 2 seconds. This oscillator test must be recorded on magnetic tape and will effectively check camera alignment, LSI 240 CPU operation and the tape read after write electronics. The test checks all of the system with the exception of the LI and LS interface boards and the station units. It is recommended also that this oscillator test be inserted at the beginning of each new tape. In order to check the remainder of the system the operator should use mode 322 and retain the printout for inclusion with the observers reports.

MONTHLY TESTS. Modes 210, 211, 212 and 320 are suitable for equipment tests recorded on separate magnetic tape at intervals of one month.

PRESURVEY ELECTRONICS CHECK. It is recommended that wave shapes and voltage levels in the tape transport be checked prior to the commencement of a survey.

ROUTINE OPERATION. The following procedure can be used as a guide for routine operations.

LINE CHECKING. Modes 110, 111, 112 and 113 are suitable for checking the line. RECORDING. Modes 100 can be used to form the line and can be chained with mode 201 for production recording.

In the event of errors being reported during production it is recommended that a single instantaneous electric detonator be used to simulate a shot rather than risk losing more charges through equipment faults. The record length can be set to one second for such testing and the tape by-pass used if the error is not related to the tape.

8 CONCLUSIONS

The test survey was a success and the SN368 equipment proved reliable and superior to the DFSIV. The system versatility is an important attribute with this type of equipment. Currently members of the seismic section acknowledge that their experience

with this equipment is limited and that several surveys will be required before the situation changes.

It is recognised by the authors that, because of the complexity of operating modes, a certain degree of dedication will be required by future operators.

Technical personnel who ultimately will be responsible for the maintenance of this equipment must be proficient with all operating modes and the only opportunity available for them to achieve this is to operate the equipment for extended periods of time during routine production. That is to say there is an urgent need for technical personnel to operate the equipment for several months on a production survey.

The technical maintenance of the SN368 equipment will require technical personnel to have a complete knowledge of operating modes, be able to manage normal acquisition of seismic data, be proficient at electronic repairs and eventually develop a knowledge of computer programming using the LSI-240 asembler codes.

Some doubts still exist on the deployment of station units and cables. These items of equipment are expensive and would be subject to theft or vandalism if exposed to the general public. Only further field experience will provide a solution to this problem.

The new Sercel cable is much lighter than that used with the DFSIV, 48 channel system and there is not a requirement for a 30 cwt vehicle to be used as a "jugwagon". It has been determined that Toyota flat tray diesel utilities will suffice as "jugwagons" provided 4 units are available. The use of 4 vehicles will enable the deployment of both cables and stations units to be efficient.

9 ACKNOWLEDGEMENTS

The Bureau of Mineral Resources acknowledge the invaluable assistance provided by Geoff Bell from Seismic Supply during his stay with the survey party. The cooperation of the staff at the Western Creek forestry station was also much appreciated.

10 REFERENCES

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11 Appendix 1 SN368 equipment list, June 1986

ITEM	QUANTITY	SERIAL NUMBERS
Central control unit	1	
Master control Unit	1	17
Power Supply	1	17
Display Unit	1	17
Magnetic Tape PE-GCR	1	17
Epson LX-80 Printer	1	029779
Inverter 12V to 240V		
(Invertech INV-100-VA)	1	2425
Cross Station Unit	2	CSU44, CSU168
Time break-Uphole Unit	2	TBUH113, TBUH152
Line Power Station Unit	4	PSU195, PSU196,
		PSU352, PSU353
Station Units	109	SU3403 to SU3460
		SU6436 to SU6451
		SU6286 to SU6320
Cables, 65 metre, DR8 plugs	96	
Take-outs	101	
Camera--SIE ERC 10C	1	26608
LSI keyboard		17
Spares kit A	1 set	
Spares kit B	1 set	
Spares kit tape transport	1 set	

12 Appendix 2 Operational statistics

Drilling commenced	22-05-1986.
Recording commenced	26-05-1986.
Drilling completed	11-06-1986
Recording completed	12-06-1986
Subsurface coverage	27 km
Recording days	11
CDP fold (average)	10
Total number of shots	100
Explosives	800 kg
Detonators	125
Charge size	8.2 kg
Rig days	16
Metres drilled	3660 meters

13 Appendix 3 Spread and recording parameters

Spread length		Varied to 6 km
Number of channels		96
Geophone station interval		60 m
CDP fold		10
Geophone pattern		16 in line 4 m appart
Recording mode		PE 1600BPI
		GCR 6250 BPI.
Format		SEG-D
Number of input channels		96 data, 4 auxiliary
Record unit length		1024 ms
Record length in UNITS		6
Sampling rate		2 ms
Pre-amplifier gain		42 dB
Notch filter		out
Low cut filter		8 Hz
High cut filter		178 Hz
AGC settings		
Slope	3 ms	
Seis gain	18 dB	
Output adjust	5	
Release time	40 ms	
Compression delay	8	
Recovery delay	32	

14 Appendix 4 Personnel and vehicles

PERSONNEL

Party leader	F.J. Taylor
Party manager	J.A. Somerville
Geophysicists	M.J. Sexton
	D.W. Johnstone
Technical Officers (Engineering)	G. Jennings,C. Rochford
	J. Whatman
Technical Officers (Science)	G. Price,D.E. Pfister
Field Assistants	R.D.E. Cherry,A.C.Takken
	S. Howard
Field Hand	R .Hazelwood
Mechanic	A. Crawford
Drillers & Assistant	T. Shanahan,S. Hancock
Seismic Supply Representative	G. Bell

VEHICLES

Recording truck	1 x International D1610
Workshop truck	1 x Mercedes Benz 911 4 x 4
Computer truck	1 x International Acco 2 x 4
Drilling rig	1 x Mayhew 1000/Mack 6 x 8 truck
Drill water tanker	1 x Mack R875, 6 x 6, 1900 gallon
Shooting truck	1 x Toyota, tray top, 4 x 4
Personnel carriers	2 x Toyota Troop Carriers, 4 x 4
Geophone carriers	3 x V8 Jeep, 4 x 4
Pre-loading truck	1 x Toyota, tray top, 4 x 4

15 **Appendix 5 DRE, SN368 vocabulary numbers.**

Department of Resources and Energy, Vocabulary of Stores, SN368 vocabulary numbers.

SEISMIC DATA ACQUISITION TELEMETRY SYSTEM "SERCEL" SN368

XDI-200 CENTRAL CONTROL UNIT CCU, COMPRISING: MASTER CONTROL UNIT MCU "SERCEL" SN368; POWER SUPPLY UNIT PSU "SERCEL" SN368; DISPLAY UNIT (CONSOLE) DU "SERCEL" SN368; PRINTER "EPSON" LX80, S/N 029779; CAMERA

XDI-201 MAGNETIC TAPE TRANSPORT TT "SERCEL" SN368, DUAL DENSITY 1600 BPI PE/ 6250 BPI GCR S/N 17

XDI-202 STATION UNITS REMOTE SU "SERCEL" SN368 S/N'S 3403-3460, 6286-6320, 6436-6451 (109 UNITS)

XDI-203 POWER SUPPLY UNIT PSU "SERCEL" SN368 S/N'S 195, 196, 352, 353

XDI-204 SHOT UNIT TB/UH "SERCEL" SN368 S/N'S 113, 152

XDI-205 CROSS STATION UNIT CSU "SERCEL" SN368 S/N'S 44, 168

XDI-206 ACCCESSORIES FOR "SERCEL" SN368, COMPRISING: LSI KEYBOARD; TAPE SPEED MODULE SET; SPARES KIT A CCU; SPARES KIT B CCU; SPARES KIT GCR MAGNETIC TAPE TRANSPORT; MOUNTING HARDWARE

XDI-207 LINE CABLES, SET, FOR "SERCEL" SN368 (65m LENGTH, DR8 PLUGS)

ZSD-040 SEISMIC DATA ACQUISITION SYSTEM DOCUMENTATION, "SERCEL" SN368 COMPRISING:

(1) USER'S POCKET GUIDE

(2) USER'S GUIDE

(3) MASTER CONTROL UNIT MCU DIAGRAMS AND CIRCUITS

(4) FIELD STATION UNIT CIRCUIT DIAGRAMS

(5) POWER SUPPLY UNIT PSU MANUAL WITH CIRCUIT DIAGRAMS

(6) DUAL TAPE TRANSPORT TT DRAWINGS

(7) DUAL TAPE TRANSPORT TT TECHNICAL MANUAL

(8) SOFTWARE MANUALS COMPRISING: LINE; DUMP; TEST; MONITO(R); SHOT; HELP

16 Table 1

Contents of the context memory for the shot at station 1263.

DATE 174/86 TIME 10:15:43 VERSION 1.2 PAGE 001

CONTEXT MEMORY ZONE = 0

ADDRESS	MNEMO	VALUE	ADDRESS	MNEMO	VALUE
000	RNOT	0000	001	GNOT	0000
002	FNOT	0096	003	FCPL	0001
004	FCPG	1228	005	LFCI	+000
006	RUPL	0001	007	RUPG	1297
008	PSTA	5244	009	RECN	0089
010	RECL	0006	011	DEL	0000
012	SEAR	0146	013	NTRA	0036
014	SLOP	0003	015	GCUR	0002
016	SMG	0018	017	OUTA	0005
018	RTIM	0040	019	CDEL	0008
020	EARG	0066	021	AGC	0001
022	RDEL	0032	023	MODE	0201
024	GRNU	0001	025	LINU	0001
026	SHIN	0001	027	NELR	0001
028	ROL	0001	029	ICE	0001
030	PWRF	0000			

CONTEXT MEMORY ZONE = 1

ADDRESS	MNEMO	VALUE	ADDRESS	MNEMO	VALUE
048	NOL	0001	049	NORT	0096
050	SR	0002	051	EXPL	0000
052	STAC	0000	053	PBAG	0018
054	SCN	0000	055	SUC	0002
056		0000	057		0007
058		0000	059		0008
060		0018	061	AUC1	0002
062		0000	063		0007
064		0000	065		0008
066		0018	067	AUC2	0002
068		0000	069		0007
070		0000	071		0000
072		0018	073	AUC3	0002
074		0000	075		0007
076		0000	077		0000
078		0018	079	AUC4	0002
080		0000	081		0007
082		0000	083		0000
084		0018	085	LPBF	0012
086	HPBF	0090	087	PBGN	0001

CONTEXT MEMORY ZONE = 2

ADDRESS	MNEMO	VALUE	ADDRESS	MNEMO	VALUE
112	SUT	0001	113	AUXS	0001
114	AUXL	0000	115	FOTB	0000
116	TBW	0300	117	RECT	0001
118	RSI	0000	119	THFI	0000
120	RLU	1024	121	CDON	1300
122	CDOF	1000	123	PBSI	0000
124	CNOT	0048	125	ORGE	0002
126	PTFI	0000	127	CHN1	0100
128		0201	129		A403
130		0000	131		0000
132	CHN2	0000	133		0000
134		0000	135		0000
136		0000	137	CHN3	0220
140		A403	141		A222
142		A403	143		0000
144		0000	145		0000
146		0000	147	LTV	0003
148		0009	149		0006
150		0009	151		0028
152		0009	153	GTV	0003
154		0009	155		0006
156		0009	157		0028
158		0009	159	UFRT	0001
160		0000	161		0000
162		0001	163		0000
164		0000	165		0001
166		0000	167		0000
168	NSN	0500	169	NTT	0400
170	OFTT	1000	171	LPBR	9600
172	HME	0000	173	OFI	0000
174	MONO	0001	175	SSEI	0000
176	RSD	0000	177	GCE	0001
178	TELE	0000	179	NRS	0024
180	NGW	0001	181	NFS	0024
182	LCP	9999	183	AUTI	0000
184	EGLK	0036	185	OALK	0004
186	EBLA	0000	187	SPNL	0001
188	SPNG	1263	189		0000

CONTEXT MEMORY ZONE = 4

ADD	VALUE	ADD	VALUE	ADD	VALUE	ADD	VALUE
300	+0000	301	+0189	302	+1233	303	+1086
304	-0689	305	-0722	306	-0270	307	-0346
308	-0345	309	-0278	310	-0242	311	-0206
312	-0167	313	-0132	314	-0098	315	-0067
316	-0039	317	-0014	318	+0008	319	+0028
320	+0045	321	+0059	322	+0071	323	+0080
324	+0087	325	+0092	326	+0095	327	+0096
328	+0096	329	+0094	330	+0091	331	+0087
332	+0082	333	+0076	334	+0070	335	+0064
336	+0057	337	+0050	338	+0043	339	+0036
340	+0029	341	+0023	342	+0016	343	+0010
344	+0005	345	+0000	346	-0004	347	-0009
348	-0013	349	-0016	350	-0019	351	-0022
352	-0024	353	-0026	354	-0027	355	-0028
356	-0029	357	-0029	358	-0029	359	-0028
360	-0028	361	-0027	362	-0026	363	-0025
364	-0023	365	-0022	366	-0020	367	-0019
368	-0017	369	-0016	370	-0014	371	-0012
372	-0011	373	-0009	374	-0007	375	-0006
376	-0004	377	-0003	378	-0002	379	-0001
380	+0000	381	+0000	382	+0001	383	+0002
384	+0003	385	+0003	386	+0004	387	+0004
388	+0005	389	+0005	390	+0005	391	+0005
392	+0005	393	+0005	394	+0005	395	+0005
396	+0000	397	+0000	398	+0000	399	+0000

17 Table 2

AMG CO-ORDINATES

		EASTING	NORTHING
LOCATION	1000	262612.	6922835.
LOCATION	1038	264874.	6922545.
LOCATION	1068	266662.	6922334.
LOCATION	1100	268570.	6922114.
LOCATION	1154	271787.	6921726.
LOCATION	1159	272085.	6921687.
LOCATION	1211	275181.	6921302.
LOCATION	1225	276016.	6921208.
LOCATION	1258	277982.	6920982.
LOCATION	1286	279651.	6920772.
LOCATION	1340	282864.	6920354.
LOCATION	1380	285245.	6920051.
LOCATION	1428	288106.	6919713.
LOCATION	1443	288999.	6919607.

18 Table 3

ELEVATIONS, STATIONS 1000 TO 1443

318.0	319.3	320.8	322.1	323.3	322.6	321.3	320.0
319.5							
319.4	319.5	320.0	320.0	318.7	317.7	316.9	316.0
315.3	314.4	313.8	313.3	312.7	312.2	311.6	311.0
310.6	310.2	310.1	310.1	310.1	310.1	310.2	310.2
310.1	310.1	310.2	310.2	310.1	310.2	310.4	310.6
310.9	311.5	312.2	312.8	313.7	314.5	315.3	316.0
316.7	317.9	319.1	320.2	321.6	322.2	322.4	322.3
321.9	321.8	322.1	322.6	323.5	324.1	325.4	327.5
329.2	330.0	330.2	331.2	330.6	329.9	328.8	328.1
328.9	329.8	329.9	329.7	329.9	329.5	329.9	330.4
330.6	331.2	332.0	332.8	333.3	334.4	334.9	336.1
337.3	337.8	337.3	338.4	338.9	340.2	340.5	339.5
337.2	334.1	332.1	330.9	329.8	329.1	328.6	328.0
328.0	328.2	328.5	329.4	329.0	329.0	328.1	327.1
327.1	326.8	327.4	328.7	329.5	329.5	328.8	327.9
326.5	324.4	320.9	318.0	316.5	316.0	314.6	313.6
313.0	312.0	311.1	310.4	309.5	308.7	307.8	307.1
306.3	305.7	305.3	305.0	304.7	304.4	302.2	303.7
304.5	305.1	305.1	304.8	305.7	304.5	302.4	301.3
300.5	298.7	294.8	290.2	297.5	300.9	303.0	303.0
303.8	304.3	304.1	303.8	303.3	302.5	302.4	302.2
303.8	304.6	305.4	306.4	307.1	307.5	307.6	307.3
308.0	309.2	310.5	312.0	313.0	313.7	314.4	314.9
315.4	315.5	315.6	315.8	316.2	316.3	316.5	316.6
316.8	317.1	317.2	316.9	316.6	316.3	316.0	315.6
315.1	315.1	314.7	314.5	314.4	314.1	313.7	313.5
313.4	313.0	312.2	311.3	310.3	310.5	310.6	311.3
311.6	312.0	313.4	314.2	315.0	315.7	316.2	316.6
316.8	316.8	316.3	315.1	316.8	317.3	317.9	318.2
318.5	318.6	319.1	319.3	319.8	320.1	320.4	320.8
321.1	321.2	321.3	321.4	321.7	322.1	322.4	322.7
323.0	323.4	323.7	324.2	324.6	325.0	325.2	325.4
325.2	325.2	324.8	324.9	324.9	325.1	325.5	325.4
325.3	325.6	325.9	325.7	325.4	325.4	325.9	326.3
326.8	326.8	327.0	327.9	328.4	328.3	327.5	327.3
327.6	328.0	327.9	328.3	328.9	329.5	329.4	329.0
328.3	328.1	328.0	328.1	328.1	328.1	328.0	327.7
327.6	327.3	326.5	327.8	328.5	329.0	329.5	330.0
330.5	330.8	331.1	331.2	331.3	331.1	331.1	331.3
331.5	331.7	332.0	332.2	332.4	332.5	332.5	332.7
333.1	333.4	333.6	334.0	334.3	334.5	334.8	335.3
335.6	335.7	336.1	336.5	336.7	337.8	337.5	338.1
338.8	339.4	339.8	340.1	340.5	340.7	340.9	341.2
341.4	341.7	342.0	342.2	342.2	342.4	342.5	342.6
342.8	342.9	342.9	343.0	343.1	343.2	343.3	343.4
343.5	343.8	344.0	344.2	344.3	344.4	344.5	344.8
344.9	345.0	345.2	345.5	345.5	345.6	345.6	345.6
345.6	345.6	345.5	345.4	345.2	344.6	343.5	344.1
344.4	344.4	344.3	343.7	343.3	342.8	342.4	341.9
341.4	341.4	340.5	339.8	339.5	339.6	339.3	339.3
339.4	339.3	339.1	339.1	339.3	339.9	340.7	341.2
341.3	340.8	340.2	339.5	338.9	338.2	337.5	336.7
336.7	336.5	336.2	334.5	336.0	335.8	335.8	335.8
335.8	335.5	335.1	334.7	333.7	332.9	332.5	334.2
335.8	336.5	337.1	337.7	338.3	339.0	339.9	340.7
341.6	342.1	342.4					