BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

RECORD 1987/21

WEST SURAT BASIN REFRACTION SURVEY, 1986:

OPERATIONAL REPORT

by

R.Bracewell & D.M.Finlayson

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ABSTRACT

This Record describes BMR wide-angle reflection/refraction seismic profiling conducted during 1986 across the West Surat Basin, Queensland. It also includes details of the refraction shots recorded by BMR's Sercel SN368 96 channel reflection spread. The survey used 14 shots containing a total of 4.4 tonnes of explosive to make seismic recordings at 62 sites along north-south and east-west lines. Each line was approximately 200km long. This Record gives details of the field work and equipment used and tabulates the station and shot data.

INTRODUCTION

During 1984 BMR conducted seismic reflection profiling along a traverse extending across the Nebine Ridge and Surat Basin (Wake-Dyster and others, 1984). The two-way recording time for the profiling data was 20 seconds. This profile identified a prominent reflector within basement at a minimum two-way time of 5 seconds on the western margin of the Surat Basin. Further west, there was evidence of deep reflectors dipping westwards under the Nebine Ridge. The prominent reflector at 5 seconds two-way-time (TWT) was only apparent on the one BMR east-west reflection traverse. It was decided that follow-up seismic reflection profiling and wide-angle reflection/refraction profiling was appropriate to determine three-dimensional structural features and obtain an indication of the velocity structure.

This Record describes the survey operations conducted during 1986 using wide-angle reflection/refraction methods to determine the deep velocity structure on the western side of the Surat Basin. The Record documents the basic survey shot point and recorder information which will be used in later interpretation.

SEISMIC SURVEY PLANNING AND DESIGN

Reconnaissance

R.Bracewell of the BMR visited the area three weeks prior to the recording crew with the purpose of:

1) Locating the shot sites. In most cases the landowner was contacted and permission to drill was obtained. Where fences were well off the road, the smaller shots could be sited on shire council land.

2) Arranging the drilling. The BMR drilling crew was already in the district drilling shot holes on the reflection line. It was arranged for one drilling rig to drill all the refraction shots.

3) Reconnoitering the survey area. Most of the refraction lines followed existing roads but several problem sites were identified. These were investigated for access. In all cases landowners were very helpful.

Refraction Survey

The survey consisted of two lines, an east-west one and a north-south one intersecting at their mid-points (Fig 1.). Existing roads and tracks were used for the major part of the lines. Part of the north-south line followed the bulldozed track forming BMR reflection profiling line 18. The central part of the east-west line was coincident with BMR reflection profiling traverse 14 (1984). The north-south line ran approximately from

20 km south of Injune to 20km north of St George (Fig 1.). The stations were positioned 5km apart between shot sites. Off-end recording sites were 8km apart except for the last site which was 20km from its nearest recording site. The shots were positioned in a symmetrical manner on both lines. Seven shots were fired into each line, including two fan shots which were orthogonal to the midpoint of each line at a distance of 50 km. The other five were positioned at 25 km intervals with one located where the two lines crossed (Figs 2a & 2b).

SEISMIC RECORDING OPERATIONS

Details of the recording stations are given in Table 1(a). Dunkeld was the site of the reflection profiling base camp so it was chosen as the base for the refraction survey also. The crew split into two to deploy recorders on the first line - the east-west one. As no 1:100 000 maps were available for the survey area, 1:46 800 air photos were used to pin-point the sites. In most cases a road, fence or creek intersection with the line could be indentified on the photo and used as a site. In a few cases a peg from the 1984 BMR survey (line 14) was used.

Recordings on the north-south line were interrupted by a brief rain storm. However by the time the bulldozed section was reached the ground was firm. As in the east-west line most recorders could be concealed just off the road without having to contact the landowner. This resulted in each line being completed in three days. The second batch of seven shots was fired in one day.

Several of the refraction shots were recorded by the reflection crew using the Sercel SN 368. Five shots were recorded on line 19 and seven on line 18. All records were of 50 second duration and included a recording of absolute time from an NCE 3 clock. Details of these recordings are contained in Table 4.

Recording equipment

The recording equipment has been described by Finlayson and Collins (1980). The following instruments were used on this survey (Table 4);

1) 6 - Precision Instrument 4 channel (PI) FM tape recorders;
2) 15 - Akai, 4 channel FM tape recorders;
3) 11 - Tandberg 4 channel FM tape recorders;
4) 4 - Shot timing sets. Each set consisting of a TAM 5 amplifier, geophone, Hellige Helcosripter He 16 chart recorder and a Labtronics radio receiver to provide VNG time signals.

Details of the deployment of the above recorders on the West Surat Basin refraction profile are given in Figs 2a,b.

SHOTS

Details of the shots are given in Table 2. Each shot was drilled in a pattern with a minimum distance of 10m between holes and 100m between shots where there were more than one shot at a location. Holes were drilled to depths of 40 - 55m and each hole was loaded with 150kg of Anzite Blue and

two electric detonators. A total of 4.4 tonnes of explosives was used for the fourteen shots, four shots of 0.5 tonne each, eight shots of 0.2 tonne each, and two shots of 0.4 tonne each.

SURVEYING

While in the field, air photos were used in positioning the recording station sites. The photos used were the 1:46 800 series from the Mitchell, Roma and Homeboin sheets. After returning to Canberra orders were placed with National Mapping to produce 1:100 000 orthophoto maps of the survey area. The site positions were transfered onto these and the co-ordinates digitized. The latitudes and longitudes were obtained by computer program. Several sites on the north-south line were adjacent to the reflection survey pegs. Co-ordinates for these were produced by the Australian Survey Office.

ACKNOWLEDGEMENTS

The BMR wishes to thank the station owners who were helpful in allowing us access to their properties to site recorders and shots. In particular, Ginger Manns of Struan, B.Winter of Coonong, King Lethbridge of Normandy, Lloyd McKay of Inniscraig, and the owners of Kandimulla, Gowrie and Deepwater stations.

REFERENCES

FINLAYSON D.M., & COLLINS C.D.N., 1980 - A brief description of BMR portable seismic tape recording systems. Australian Society of Exploration Geophysicists. Bulletin 11, 75 - 77.

WAKE-DYSTER, K.D. and JOHNSTONE, D.W., 1985: Southeast Queensland Seismic Survey, 1984, Operational Report, Bur. Miner Resour. Aust., Record 1985/42.

TABLE 1

WEST SURAT BASIN CRUSTAL SURVEY 1986. RECORDING STATION DATA

Station No.	Set No.	Latitude deg min	Longitude deg min	Time on d h m	Time off d h m	Gain db
01	02	26 06.88	148 31.16	20 09 08	21 16 59	96
02	13	26 17.07	148 27.85	20 09 42	22 08 19	96
03	28	26 21.11	148 26.01	20 12 03	22 09 08	96
04	15	26 25.40	148 23.40	20 13 41	22 09 47	96
05	29	26 30.30	148 23.48	20 13 30	22 07 29	96
06	18	26 32.86	148 22.90	20 12 29	22 07 55	96
07	01	26 36.17	148 21.71	20 14 40	22 08 35	96
08	30	26 38.85	148 21.66	20 15 40	21 17 40	96
09	16	26 41.45	148 21.65	21 08 10	21 17 18	96
10	08	26 43.46	148 22.20	20 17 00	21 17 00	96
11	09	26 45.63	148 22.24	20 16 27	21 16 34	96
12	24	26 48.68	148 22.02	20 15 55	22 09 21	96
13	20	26 51.13	148 22.40	20 16 50	22 09 47	96
14	22	26 53.67	148 20.10	21 08 35	22 10 30	96
15	33	26 56.38	148 19.44	21 09 40	22 11 16	96
16	04	26 58.93	148 19.19	21 08 28	22 07 54	96
16	04	26 58.93	148 19.19	16 13 54	18 10 35	96
17	25	27 01.36	148 18.95	21 09 07	22 08 13	96

TABLE 1 (continued)

Station No.	Set No.	Latitude deg min	Longitude deg min	Time on d h m	Time off d h m	Gain db
18	23	27 03.98	148 18.60	21 09 48	22 08 35	96
19	32	27 07.06	148 18.09	21 10 35	22 09 02	96
20	06	27 09.09	148 17.74	21 11 06	22 09 19	96
21	19	27 11.02	148 19.34	20 17 08	22 09 29	96
22	05	27 13.53	148 21.62	20 16 37	22 09 52	96
23	21	27 16.19	148 22.09	20 16 04	22 10 09	96
24	17	27 18.46	148 23.06	20 15 32	22 10 27	96
25	07	27 20.76	148 23.13	20 14 25	22 11 02	96
26	12	27 22.87	148 21.06	20 14 11	22 11 20	96
27	27	27 25.34	148 19.86	20 13 48	22 11 33	96
28	11	27 29.65	148 20.11	20 12 45	22 11 45	96
29	03	27 33.34	148 21.93	20 12 18	22 12 45	96
30	31	27 37.25	148 26.63	20 11 14		96
31	14	27 40.14	148 28.58	20 11 15	22 13 23	96
32	10	27 49.11	148 31.16	20 10 48	22 13 50	96
33	32	27 03.81	147 20.14	15 12 52	17 12 23	96
34	11	26 58.82	147 31.70	15 14 06	17 13 43	96
35	12	26 57.82	147 36.50	15 14 40	17 14 05	96
36	27	26 57.36	147 41.31	15 15 32	17 14 35	96

TABLE 1 (continued)

Station No.	Set No.	Latitude deg min	Longitude deg min	Time on d h m	Time off d h m	Gain db
37	23	26 56.23	147 45.41	15 16 26	17 14 59	96
38	10	26 53.56	147 50.50	15 17 23	17 15 34	96
39	03	26 53.83	147 52.85	16 10 12	17 16 50	96
40	06	26 54.09	147 55.83	16 10 54	17 16 05	96
41	14	26 54.39	147 58.54	16 09 45	17 16 22	96
42	25	26 54.83	148 02.01	16 09 13	17 16 42	96
43	21	26 54.72	148 04.78	16 11 52	18 09 32	96
44	05	26 54.97	148 07.31	16 12 13	17 16 57	96
45	17	26 55.40	148 11.38	16 12 38	17 16 34	96
46	07	26 56.37	148 13.65	16 13 11	18 10 01	96
47	19	26 57.98	148 17.21	16 13 35	18 10 16	96
48	29	26 58.89	148 22.34	16 10 30	17 15 54	96
49	18	26 58.91	148 25.22	16 11 20	17 15 19	96
50	01	26 58.82	148 29.26	16 11 12	17 15 30	96
51	28	26 58.82	148 31.98	16 12 52	17 15 00	96
52	33	26 58.33	148 34.74	16 13 46	17 12 35	96
53	20	26 58.59	148 37.52	15 17 04	17 13 11	96
54	22	26 58.32	148 41.59	15 16 35	17 13 49	96

TABLE 1 (continued)

Station No.	Set No.	Latitude deg min	Longitude deg min	Time on d h m	Time off d h m	Gain db
55	24	26 58.26	148 44.69	15 15 55	17 14 18	96
56	15	26 57.56	148 47.34	15 15 28	17 14 15	96
57	13	26 56.22	148 49.22	15 14 55	17 13 45	96
58	30	26 54.50	148 54.26	15 14 25	17 13 14	96
59	02	26 53.74	148 58.96	15 14 00	17 12 42	96
60	16	26 54.16	149 04.20	15 13 10	17 11 56	96
61	09	26 54.82	149 09.58	15 12 35	17 11 28	90
62	08	26 53.99	149 20.62	15 11 40	17 10 52	96

TABLE 2

WEST SURAT BASIN CRUSTAL SURVEY 1986, SHOT INFORMATION.

Shot No.	Location (site no)	Time d h m s	Size t	Latitude deg min	Longitude deg min
01	57	16143504.97	0.5	26 56.22	148 49.22
02	16	16150604.99	0.4	26 58.93	148 19.19
03	44	16162005.02	0.2	26 54.97	148 07.31
04	27	16163005.01	0.2	27 25.34	148 19.86
05	52	16164004.83	0.2	26 58.33	148 34.74
06	06	17102004.78	0.2	26 32.86	148 22.90
07	38	17103505.05	0.5	25 53.56	147 50.50
08	16	21120004.70	0.4	26 58.93	148 19.19
09	11	21121004.79	0.2	26 45.63	148 22.24
10	21	21122004.99	0.2	27 11.02	148 19.34
11	27	21141005.03	0.5	27 25.34	148 19.86
12	57	21142004.77	0.2	26 56.22	148 49.22
13	06	21143005.11	0.5	26 32.86	148 22.90
14	38	21163005.10	0.2	25 53.56	147 50.50

TABLE 3

WEST SURAT BASIN CRUSTAL SURVEY 1986, REFLECTION SPREAD DETAILS

Shot No.	Site No.	Spread (Peg No.)	Three component geophones (Peg No.)	Line No.	Tape No.
03	44	1096-1191		19	86/022
04	27	1096-1191		19	86/022
05	52	1096-1191		19	86/022
06	06	*1102-1197	1110,1150,1190	19	86/022
07	38	*1102-1197	1110,1150,1190	19	86/022
02	16	940-1035		18	86/022
09	11	940-1035		18	86/022
10	21	940-1035		18	86/022
11	27	964-1048		18	86/026
12	57	964-1048		18	86/026
06	06	964-1048		18	86/026
14	38	964-1048		18	86/026

*Note. Trace numbers are not equivalent to station numbers due to the addition of the three component geophones into the spread, (ie. the first channel position on tape corresponds to site 1108 not 1102).

TABLE 3 (continued)

The channel positions for the three component phones used during shot 6 and 7 were as follows:

Site	Vertical	Radial	Transverse
1110	1110	1111	1112
1150	1150	1151	1152
1190	1190	1191	1192

TABLE 4

RECORDING EQUIPMENT

Set Nos	Recorder Type	Seismometer Type	Amplifier Type	Clock	Polarity (see Note)
1 to 15	Akai	Willmore MK.III	TAM 5	NCE 3	Mass down signal down
6 to 21	Precision Instrument	Willmore Mk.II	TAM 5	NCE 3	"
22 to 27	Tandberg	Willmore Mk.II	Geotech	NCE 3	"
28 to 33	Tandberg	Willmore Mk.III	Geotech	NCE 3	"

Note: 1) Mass down applies for an impusive P-wave arrival.

2) Signal down refers to the trace played back from tape through the Siemens analogue chart recorder.

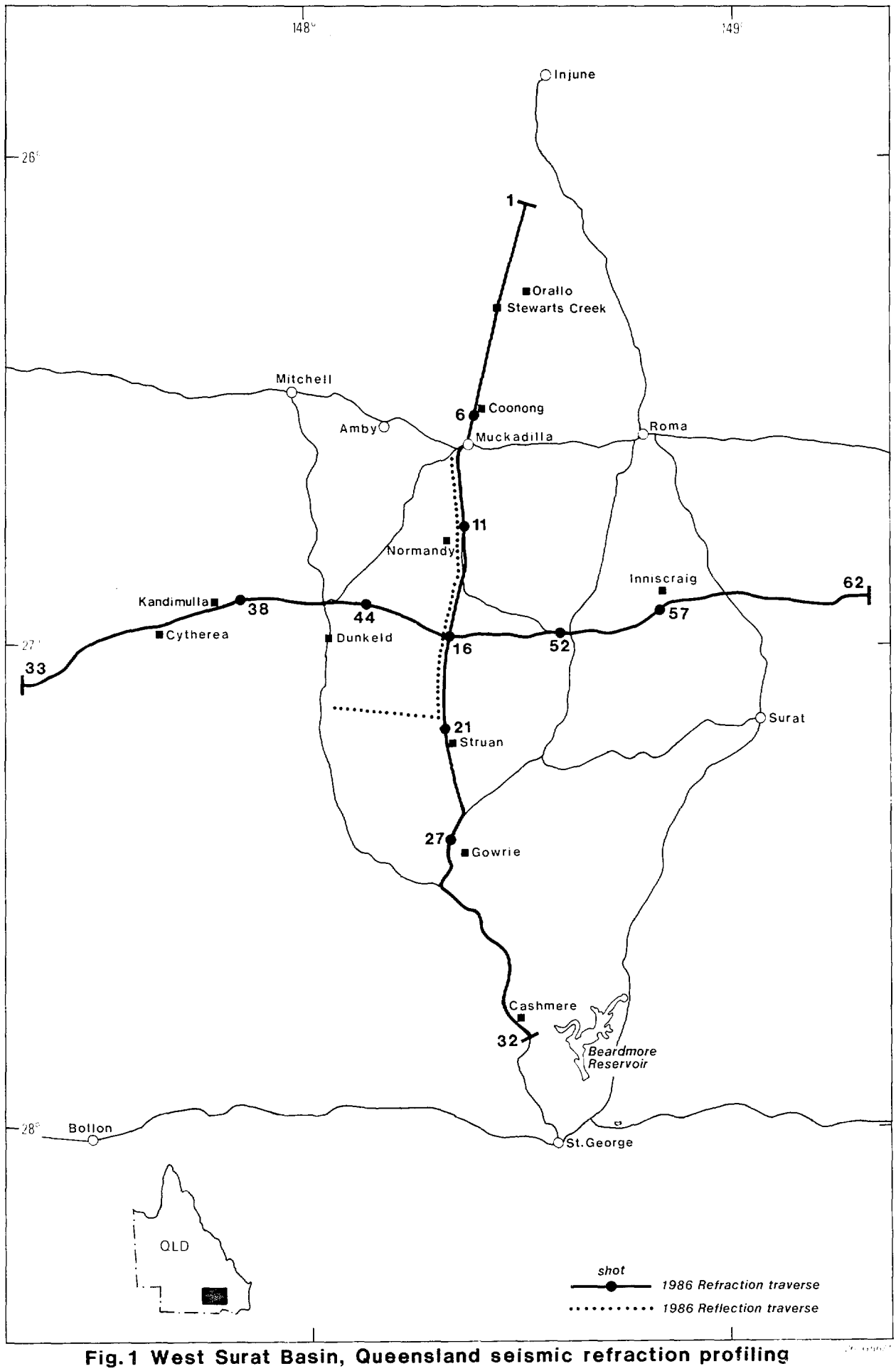

Fig. 1 West Surat Basin, Queensland seismic refraction profiling

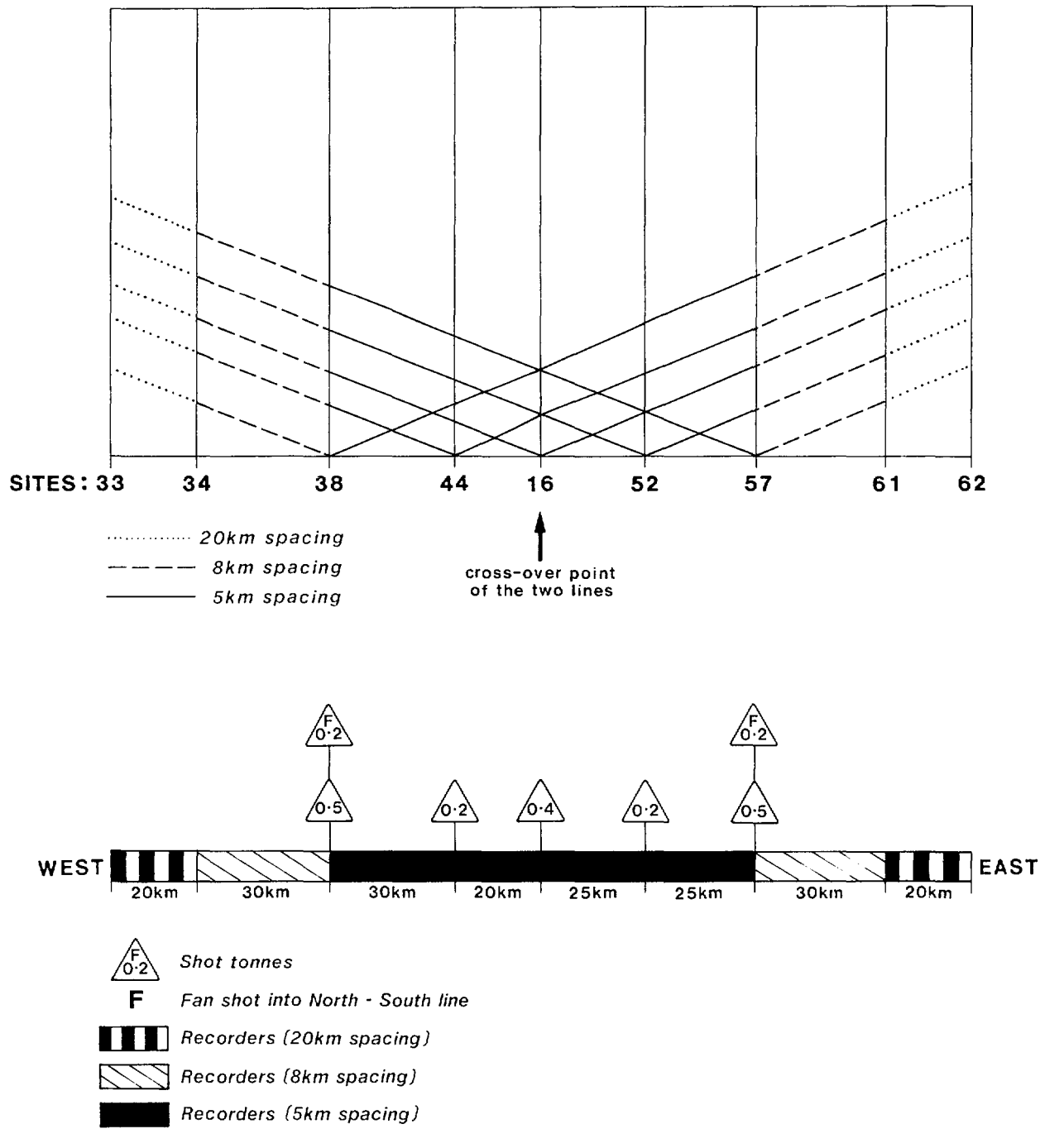

Fig.2a Details of recording operations, West Surat Basin refraction survey 1986 East - West line

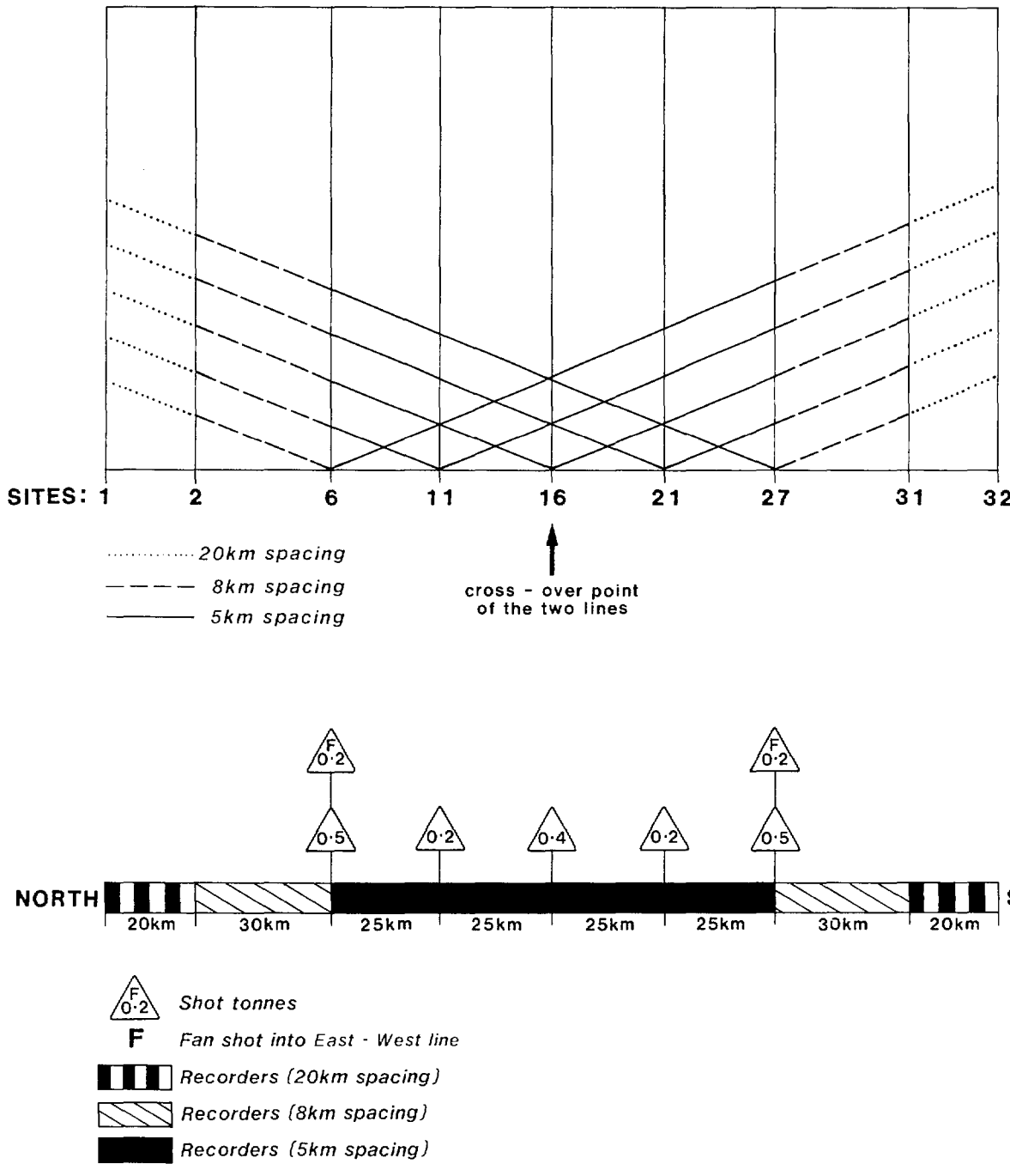

Fig.2b Details of recording operations,West Surat Basin refraction survey 1986
North - South line