Seismograph Service (England) Limited

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COMPANY: NORSK HYDRO A/S WELL: 31/3-2

OFFSET SOURCE V.S.P. PROCESSING COMMENT

Two OVSP check shot surveys were recorded in the above well on 2.4.84 between 2075 and 1100 m below RT. The energy sources were mounted on two boats ("m.v. POLARSON" and "m.v. STAD SAILOR") and secured at a depth of 10 m. The positioning system used by the boats was the ARTEMIS MK III and the navigational survey was performed by RACAL SURVEY NORGE A/S. The gun positions were 700 m south of the wellhead and 1200 m north of the wellhead subject to the tolerance of the navigational survey. Data was recorded at similar depths for both surveys with two exceptions. The level at 1350 m below RT on the north offset survey corresponds to the level at 1355 m below RT on the south offset survey and the level at 1100 m below RT has been recorded only on the north offset survey. As the first arrival is distorted for this level at 1100 m below RT, it has been omitted from processing. No offset data was recorded for the level at 1600 m below RT due to high amplitude low frequency noise which affects even the rig source data at this depth. Although the caliper log gives no indication of washout in the immediate vicinity of this depth it is considered that the noise is probably caused by poor coupling between the geophone and the formation possibly due to the nature of the formation in this region.

Both sets of VSP displays were processed using the sequence indicated on the attached side labels. For the north offset survey, source signature deconvolution (derivation window 300 ms) was carried out on the stacked data in an attempt to collapse the bubble energy into the first arrivals. However, for the south offset survey, the hydrophone signal transmitted from the boat to the equipment on the rig was distorted causing the source signature deconvolution to give poor results and therefore it has not been employed on this survey. Nevertheless the consistent nature of the signal on the geophone data has enabled the bubble energy to be collapsed into the first arrival during the Special VSP Deconvolution using the downgoing wavefield.

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Downgoing wave subtraction was carried out on both surveys. In the case of the north offset survey, the downgoing wavefield was found to exhibit moveout probably due to variations in water depth and has therefore been enhanced using a 13:1 median pick designed to enhance dips of up to 2 ms/trace to the left. Special VSP Deconvolution was also applied to both surveys using operators designed from the downgoing wavefields using window lengths of 660 and 600 ms for the south and north offset surveys respectively. It should be noted that on displays 4 and 5 the data is blanked up to 250 ms before the first arrival. This means that some low amplitude data appears before the first arrivals on these displays, especially after deconvolution when primary reflections are approximately zero phase in nature. However it is clear that the upgoing wavefields exhibit continuity up to the first arrival curve. The deconvolved downgoing wavefields (Display 7) show the effectiveness of the deconvolution operators in collapsing the downgoing wavefields within the design windows into the first arrivals. Data quality is generally fair although a number of levels are affected by low frequency noise. Again this noise, although it is less severe than that observed on the level at 1600 m below RT, is thought to come from poor coupling between the geophone and the formation probably due to the nature of the formation. It is not present on the levels at and above 1500 m below RT for which the geophone was in casing. The final bandpass filter (9-12, 50-60 Hz) has been chosen to give the best resolution possible from the given data sets and also to attenuate the low frequency noise.

An image reconstruction technique has been employed on the deconvolved data for both surveys and the results of this are shown on Displays 6A and 6B in each case. For these displays, the OVSP data have been mapped to their estimated true earth location. The axes on these displays show horizontal offset from the wellhead and two-way time below MSL as for conventional seismic data. The mapping has taken its velocity profile from the offset data as the rig source data has few levels at corresponding depths. However, where rig shots were taken at depths which were also shot on the offset surveys, the vertical times calculated from the offset data are in reasonable agreement with those from the rig. The offset scale used on the mapped displays is 1:5000. This scale was chosen for convenience as unfortunately, due to the relatively small offsets covered by the surveys, the scale of 1:25000 used on seismic section Line 8007-338 is too small to provide reasonable displays of the mapped data. In order to enhance the upgoing wavefield on the mapped display, a horizontal 7:1 median has been applied. Although there is clearly some moveout present on the mapped data, especially for the north offset survey, the data after mapping is sampled at 4 ms and therefore dips of up to 4 ms/trace should be adequately enhanced by the median employed.

Approved by:

P. Kennett
Manager, Well Survey Division

Processed by:

P. N. Armstrong

26th April 1984

MS/H

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NORSK HYDRO A/S WELL: 31/3-2

OFFSET SOURCE (SOUTH) V.S.P. STACKED GEOPHONE DATA

LEVEL NO.	DEPTH (M BELOW RT)	STACK	LEVEL NO.	DEPTH (M BELOW RT)	STACK
1	2075	6	20	1575	4
2	2050	3	21	1550	5
3	2025	3	22	1525	2
4	2000	3	23	1500	5
5	1975	2	24	1475	5
6	1950	4	25	1450	3
7	1925	3	26	1425	4
8	1900	2	27	1400	4
9	1875	3	28	1375	4
10	1850	3	29	1355	4
11	1825	3	30	1325	5
12	1800	4	31	1300	4
13	1775	4	32	1275	4
14	1750	2	33	1250	4
15	1725	4	34	1225	4
16	1700	2	35	1200	4
17	1675	4	36	1175	4
18	1650	4	37	1150	4
19	1625	3	38	1125	3

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NORSK HYDRO A/S WELL: 31/3-2

OFFSET SOURCE (NORTH) V.S.P. STACKED GEOPHONE DATA

LEVEL NO.	DEPTH (M BELOW RT)	STACK	LEVEL NO.	DEPTH (M BELOW RT)	STACK
1	2075	4	20	1575	5
2	2050	3	21	1550	2
3	2025	2	22	1525	2
4	2000	2	23	1500	4
5	1975	4	24	1475	5
6	1950	3	25	1450	3
7	1925	3	26	1425	4
8	1900	3	27	1400	4
9	1875	3	28	1375	4
10	1850	4	29	1350	4
11	1825	3	30	1325	4
12	1800	3	31	1300	4
13	1775	5	32	1275	4
14	1750	4	33	1250	3
15	1725	3	34	1225	3
16	1700	2	35	1200	3
17	1675	2	36	1175	2
18	1650	3	37	1150	3
19	1625	2	38	1125	3

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COMMENT ON ADDITIONAL PROCESSING OF OFFSET SOURCE V.S.P. DATA

The final mapped data displays have been re-processed as indicated on the side labels attached to the displays. The bandwidth of the bandpass filter has been reduced in order to increase the attenuation of both low and high frequency noise and the data has been mapped in two stages.

The first stage of the mapping involves correcting the data to two-way time below datum but no attempt is made at this stage to shift the data to its correct horizontal offset position. After this first stage, the time corrected data was enhanced by the application of a 9:1 median pick which was quite successful in improving the continuity of the upgoing energy. Finally, the data was shifted to its true horizontal offset position for the final displays.

The advantage of the two-stage mapping process is that the effect of noise on the data may be assessed at the halfway stage when each trace is still associated with a particular geophone level. In this case, it is clear that the effect of the noise, which is present on both surveys between depths of approximately 1950 and 1525 m below RT, is less severe than is apparent on the original mapped displays. The application of the median at the halfway stage has reduced the amplitude of the noise and has enhanced the upgoing energy more successfully than in the original case where it was applied after final mapping.

Overall, there is a definite improvement in the final mapped data displays although the similarities between the new mapped displays and the previous versions demonstrate the strength of the upgoing energy within the OVSP data sets. The explanation given of timing discrepancies and mis-ties between the two surveys is still applicable to the new mapped data displays.

Approved by:

P. Kennett
Manager, Well Survey Division

Processed by:

P. N. Armstrong

28.6.84.

JJD/I