SPECTRAL SMOOTHING

Two spectral smoothing operators were carried out on the raw VSP data. The first operator applied spectral smoothing across the VSP traces. This type of operator is designed to remove noise effecting some traces. An 8 trace median spectral smoothing operator was applied over the full frequency range of the raw VSP data. The second operator applied spectral smoothing across a frequency range from 40-45 Hz and had a median length of 7 Hz, this was designed to remove a consistent band of noise in F-K domain. Test shows that the application of this operator gave the optimum improvement in the VSP upwave without significantly reducing the amplitude of the signal present.

STACKED GEOPHONE DATA

Display VA1 shows the stacked geophone data before spectral smoothing. The levels from 7-24 show a general noise burst. This energy was not considered to be detrimental to the final VSP image. Display VA1 also shows that certain levels are affected by low-frequency noise. This is due to noisy condition in the open borehole, most of the low-frequency noise was succesfully removed by application of spectral smoothing, it can be seen in the display VA (stacked geophone data after spectral smoothing). Display VA(FK) shows the stacked geophone data in the frequency/wave number space. This shows the different wavefields present in the data and the extent of their frequency bandwidths. The preliminary filter (3,6-100,150 Hz) has been derived from an examination of this data in F-K space.

DOWNGOING WAVEFIELD

The estimate of the downwave was obtained by aligning the first arrivals and enhancing this data in such a way as to show the continuity of the downgoing wavefield from trace to trace without distorting any real variations due to differences in structure. A plot of the downgoing wavefield is supplied filtered with the seismic match upwave filter 3,6-40,60 Hz (Display VB2); this can be used for the identification of multiples.

UPGOING WAVEFIELD

The enhanced downgoing wavefield has been used in a subtraction process to remove the downgoing wavefield from the data leaving an estimate of the upgoing wavefield (Display VC).