PAPER Q

EVALUATING THE EFFECT OF REFLECTION VELOCITY ANALYSIS BEFORE STACK ON THE WIDE OFFSET MRGP DATA SET

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ABSTRACT

In this paper we consider the effect of reflection velocity analysis on reflection coherency before stack at several lateral point locations on the wide offset MRGP data set. We use the full range of angles or radial distances that the velocity analysis suggests can be stacked to give the most coherent reflection image possible at that particular lateral location. This approach has the advantage of giving the optimum stack possible for a localized lateral location. However, since the range of optimum angles changes greatly from the wells to the middle of the survey, it has the disadvantage of a change in the vertical spatial wavelength as a function of lateral location. We examine this approach at five lateral locations (CLP gathers) starting near the source well and going towards the middle of the data set. We see data that is well aligned for stack at each lateral location for all depths for three different bandpass filters.

INTRODUCTION

Crosswell reflection velocity analysis (Smalley, 1993) is based on the CLP sorting of crosswell data and the crosswell polar coordinate stacking system (Smalley, 1992). The objective of reflection velocity analysis is to find the stacking velocities that will maximize the coherency of the reflection data. After velocity analysis, we do CLP imaging using the stacking velocities determined from velocity analysis to map the reflection data from time to space. Reflection velocity analysis is more difficult for reflection points in the middle of the survey compared to reflection points at the wells due to the poorer signal to noise ratio. Consequently, the optimum range of angles or radial distances that can be used for the stack are fewer and at larger angles in the middle of the survey than at the wells.

VELOCITY ANALYSIS RESULTS

In figure 1 we see CLP - VLMO gathers for reflection points near the source well and in the middle of the survey after velocity analysis. We see two key differences in these gathers:

1) The signal to noise ratio is greater at the source well as opposed to the middle of the survey.

2) The range of angles or radial distances over which there is coherent reflection energy is larger at the source well as opposed to the middle of the survey.

Figure 2 shows the location of reflection velocity analysis nodes used on this survey. At each one of these nodes we performed reflection velocity analysis. The average range of angles used for all reflection depths at the source well and in the middle of the survey is shown in figure 3.

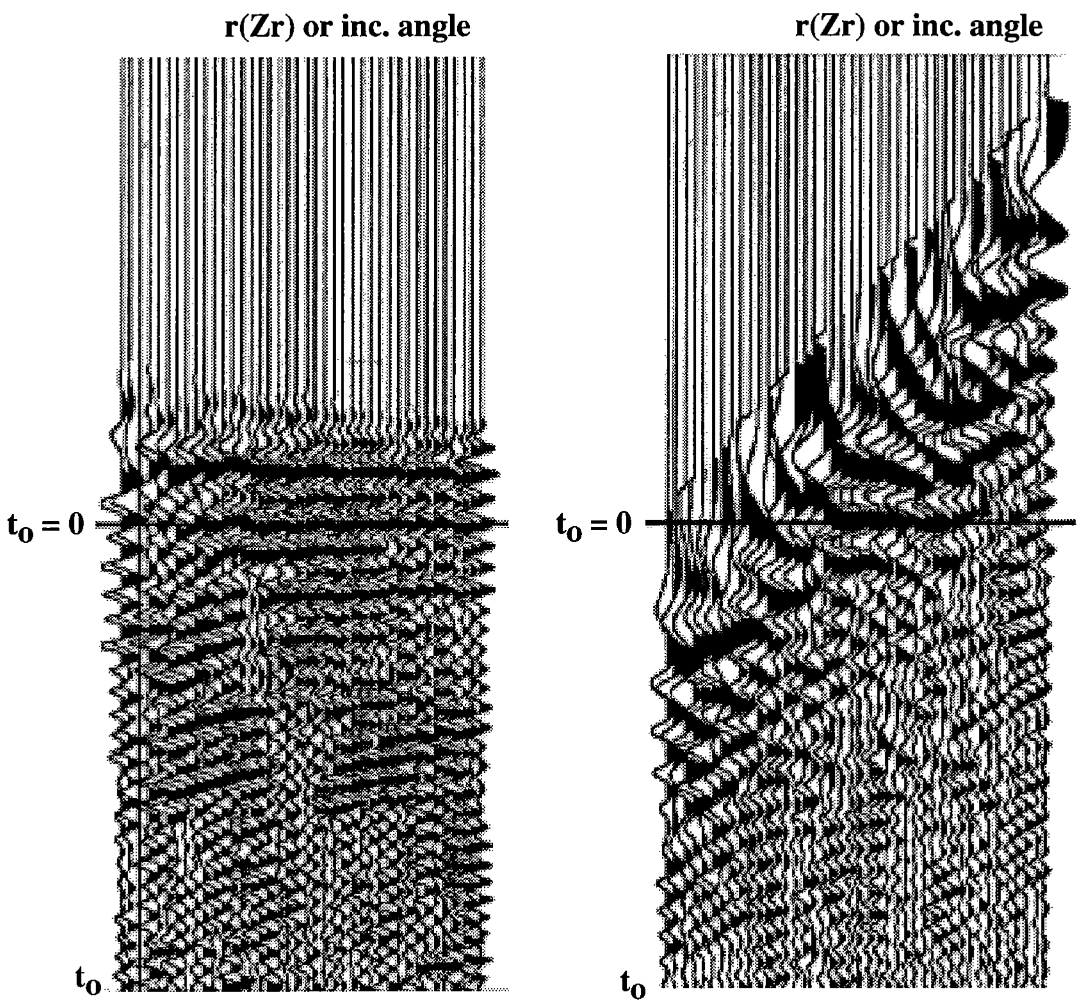

Figure 1. CLP - VLMO gathers for a reflection point near the source well (left) and a reflection point in the middle of the survey (right).

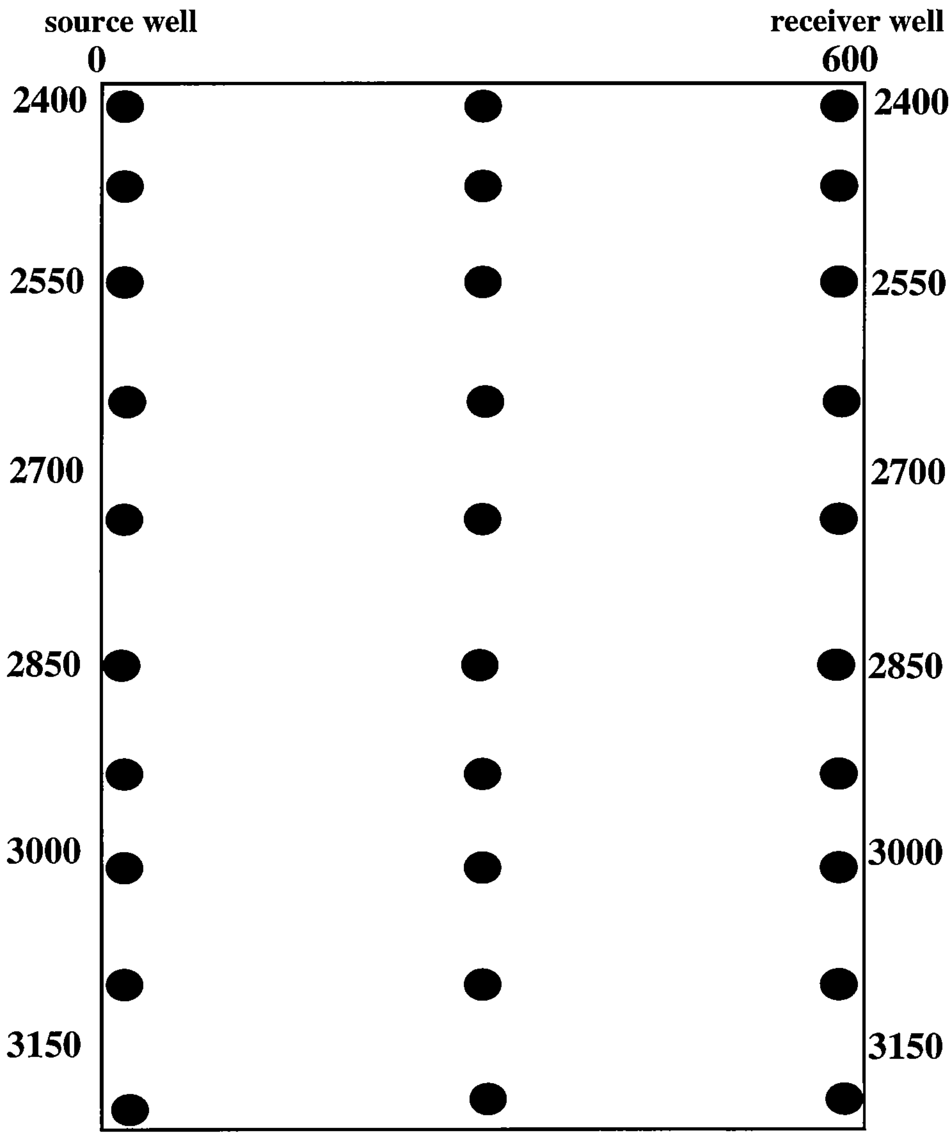

Figure 2. Location of nodes for reflection velocity analysis (units are feet).

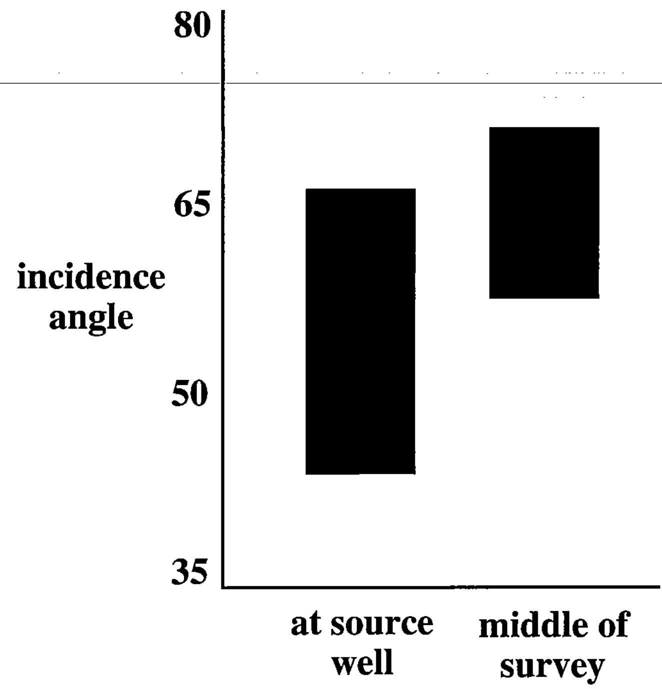

Figure 3. Average range of incidence angles used in the survey.

EVALUATING THE VELOCITY ANALYSIS ON REFLECTION ALIGNMENT

The reflection results using the velocity analysis and CLP imaging (Smalley, 1994) for five lateral point gathers (CLP gathers) are shown in figure 4. The lateral locations are 30, 90, 150, 210, and 270 feet from the source well. They are shown after additional wavefield separation and application of a bandpass filter. We show the same CLP gathers after a low bandpass filter is applied (figure 5), and after a high bandpass filter is applied (figure 6). We see the desired zero moveout for almost all of the events for the full range of depths for all three bandpass filters. Due to the different range of angles used near the source well as opposed to the middle of the wells, we see more reflection events for the CLP locations at 30 and 90 feet from the source well than for CLP locations at 210 and 270 feet from the source well. The benefit to using the full range of angles that velocity analysis suggests will give a coherent stack is a better stack for a localized lateral region. The CLP reflection imaging technique discussed in a previous paper (Smalley, 1994) kept a constant range of angles in the reflection imaging. This resulted in a consistent wavelet going from the source to receiver well. However, by forcing the range of angles used in the stack to stay constant throughout the survey, we don't get to keep all the angles or radial distances that can contribute constructively to the stack.

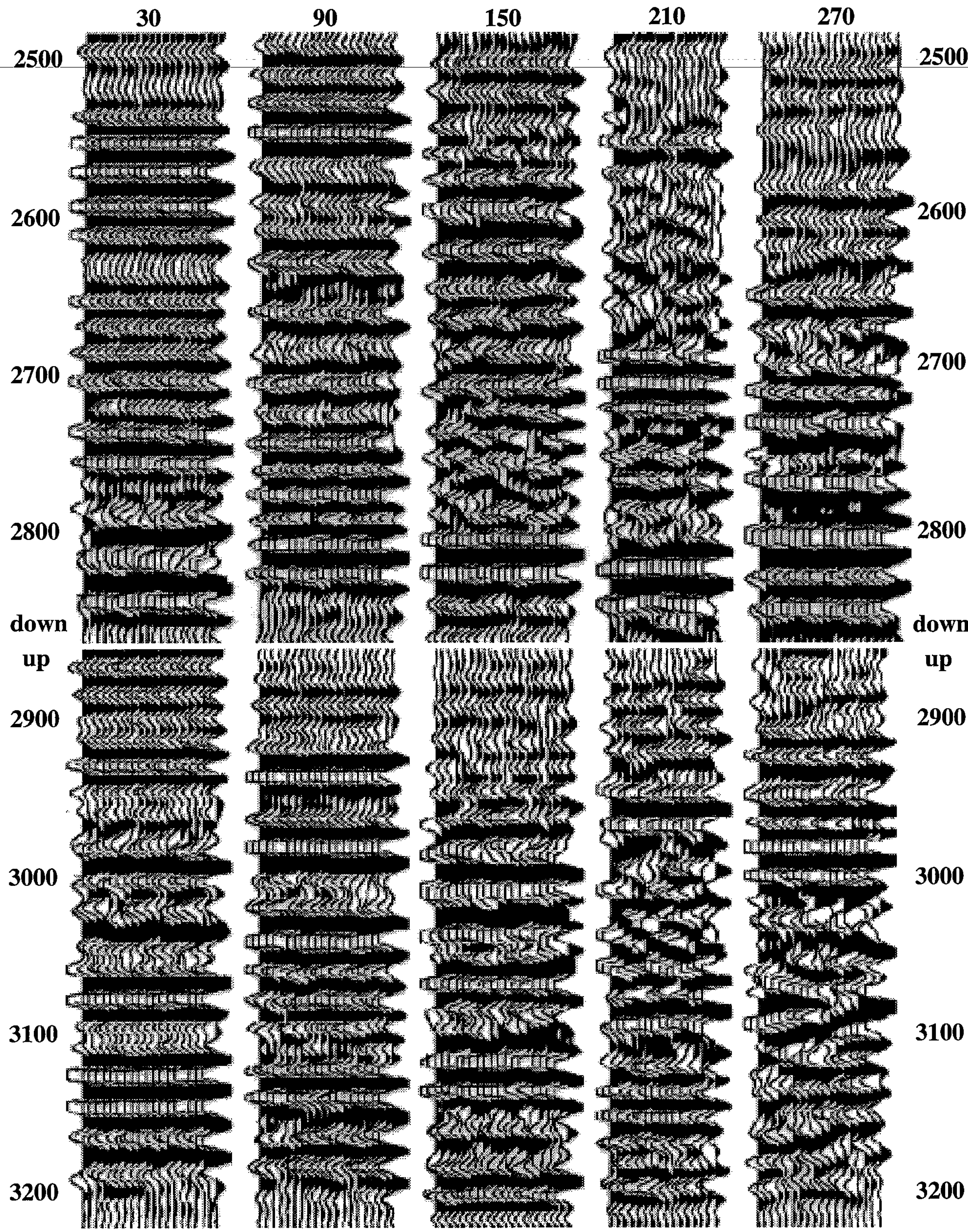

Figure 4. Five CLP gathers after velocity analysis and before stack with a bandpass filter.

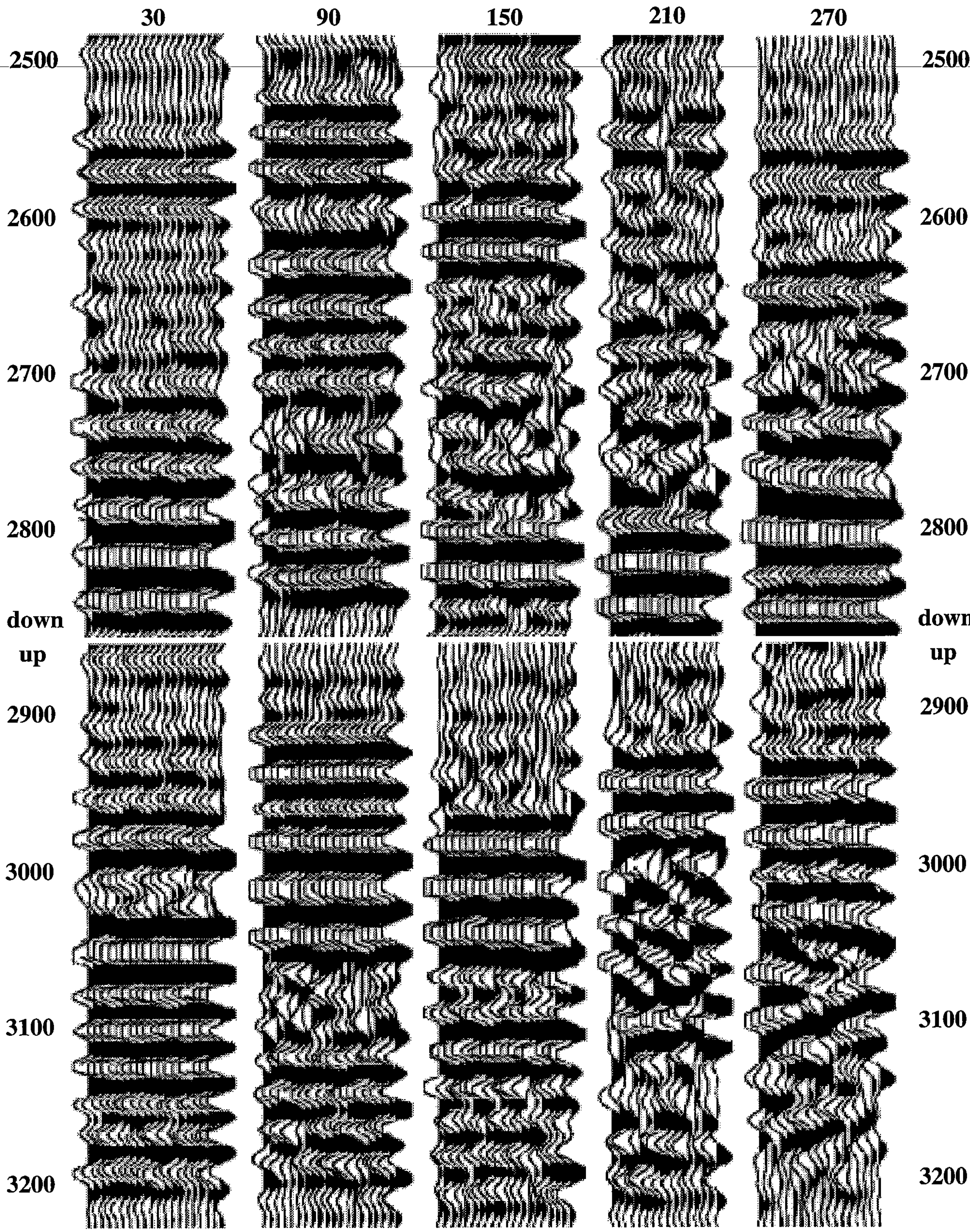

Figure 5. Five CLP gathers after velocity analysis and before stack with a low pass filter.

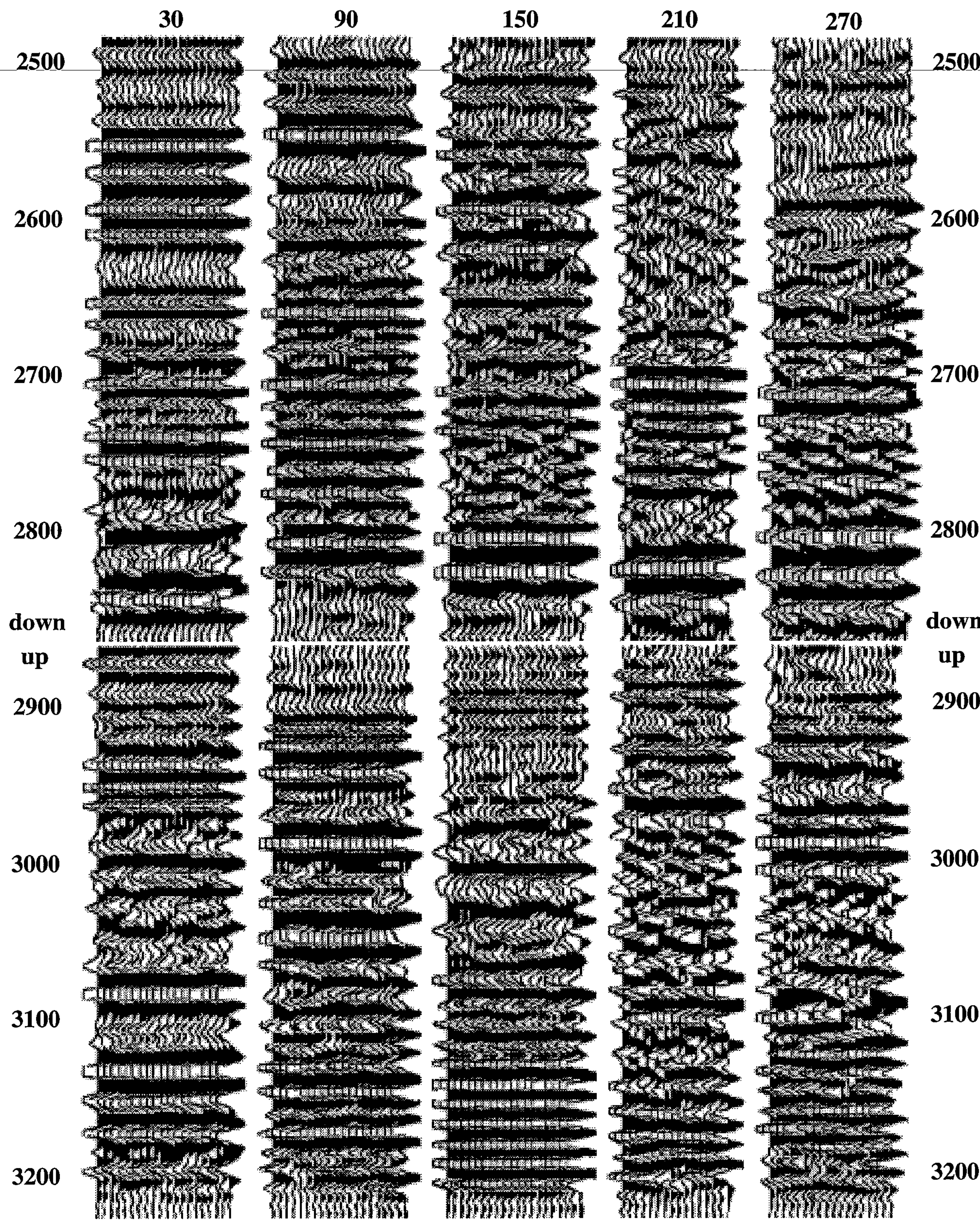

Figure 6. Five CLP gathers after velocity analysis and before stack with a high pass filter.

CONCLUSIONS

We have shown CLP gathers after velocity analysis for five lateral locations from near the source well to near the middle of the survey. We used the full range of angles or radial distances suggested by the velocity analysis for maximizing coherency in the CLP imaging on these five gathers. We see excellent alignment of the reflection data, and a change in the spatial wavelength as a function of CLP location. The potential benefits of using the full range of optimum angles in the stack would be a better stack at a specific lateral location as opposed to a better overall stack.

ACKNOWLEDGMENTS

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