PAPER A

HIGH RESOLUTION IMAGING WITH CROSSWELL REFLECTION DATA

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ABSTRACT

Crosswell data are definitely complicated. They contain a rich variety of wave modes producing a wavefield of intimidating complexity. This is probably the reason why traveltime tomography is by far the most popular type of processing applied to such data. Yet, other parts of the wavefield may be much more appropriate for achieving the coverage and high resolution necessary for accurate reservoir characterization.

In this study we enhanced the crosswell reflected wavefield through appropriate processing and used it for imaging a region between wells. Although our data were contaminated by strong, aliased tube waves, we were able to get a good tie at the well and resolution approaching that of the wireline logs. This leads us to believe that, with some improvements on the hardware and data acquisition, reflection crosswell imaging could become an extremely useful tool for reservoir characterization.

INTRODUCTION

In most crosswell studies, especially in those applied to real crosswell data, the direct arrival traveltimes have been used to invert for seismic velocities in the region between wells. Direct arrival traveltimes are definitely a robust observation that should be used whenever available. Still they represent a small fraction of the total information contained in the data. Although processing the full waveform is complicated, good quality reflection data present the potential for very high resolution imaging of reservoirs without the large data volumes necessary for high resolution crosswell traveltime tomography. This has been pointed out by several authors and a few real data studies have been published along these lines (Baker and Harris, 1984; Iverson, 1988; Beydoun et al., 1988; Abdalla et al., 1990).

This paper presents the results of reflection processing applied to crosswell data in the frequency range of a few kHz for a well spacing of around 330 ft. A series of preprocessing operations were employed to enhance and separate upgoing and downgoing P to P primary reflections, which were used to produce depth images of a region between wells. The imaging algorithm we used is similar to the VSP-CDP method (Wyatt and Wyatt, 1984), with particular attention paid to the accurate positioning of wide angle reflections.