Cvictus VSP

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ABSTRACT

CREWES participated in the acquisition of walk-away baseline and monitor cross-well and vertical seismic profile (VSP) surveys at a Cvictus combined hydrogen production and carbon dioxide sequestration site on a cost recovery basis in central Alberta in early 2022. Fifteen hundred tons of CO_2 were injected into a coal reservoir between the March baseline and February monitor surveys. Distributed acoustic sensing (DAS) data were acquired using two interrogators for downhole sparker data over a 150 m depth interval for the cross-well baseline survey and a 38 m interval for the cross-well monitor survey with a nominal twelve shots per depth level. Vibe points (VP) on four different azimuths centered on the observation well were acquired with eight sweeps per VP for the baseline VSP and sixteen sweeps per VP for the monitor survey/

The VSP survey was initially designed based on the walk-away walk-around surveys that we have conducted at Carbon Management Canada's Newell County centered on the Cvictus observation well. The design quickly collided with reality in the form of topography, land ownership, and infrastructure on the well lease, resulting in the Vibe Point (VP) locations shown in Figure 1.

There was some concern about our ability to image the approximately 1500 m reservoir depth with a small IVI EnviroVibe on the surface. Figure 2 shows that we can, although the signal-to-noise at reservoir depth is still poor with 16 sweeps per VP. First-break picking at this depth consisted of a manually drawn line rather than formally searching for a peak. Figures 3 and 4 show our initial zero-offset VSP processing for VP 2010. We arbitrarily picked a 1 s record length for source gather extraction from the continuous data. Figure 4 shows that 1.5 s would have been a better choice, although the shorter record length is fine for corridor stacks. Figure 5 shows a comparison to a synthetic seismogram that was generated using a sonic log from the observation well.

Initial time-lapse zero-offset VSP processing of VP 2010 shows no obvious post-injection amplitude or time-delay anomaly at reservoir depth (Figure 6). More work, including modelling and 2D processing of the walkaway VSP's is in progress.

ACKNOWLEDGEMENTS

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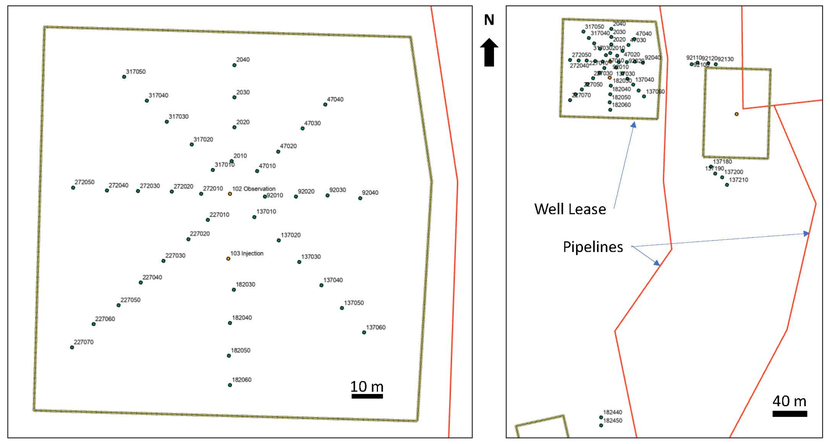

FIG. 1. Map of VP on well lease (left), repeated at a larger scale (right) to show three patches of far-offset VP, located to the E, SE, and S of the observation well.

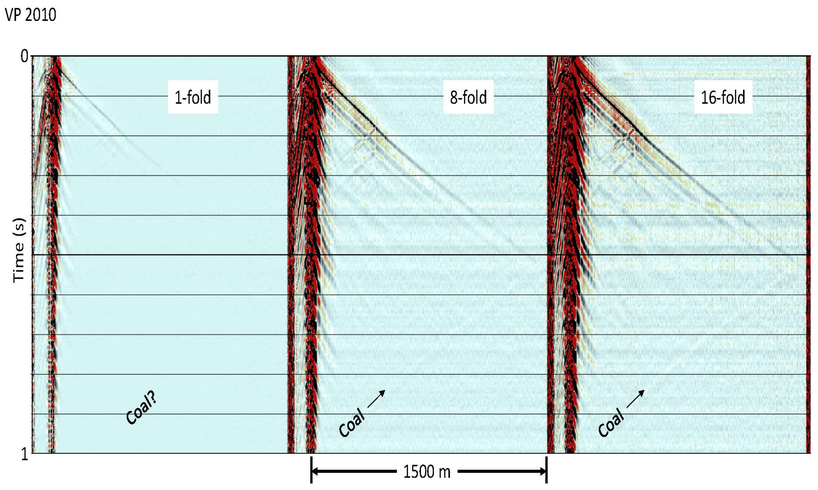

FIG. 2. February VP 2010 data with vertical fold equal to one (a), eight (b) and sixteen (c) showing signal to noise improvement with increased source effort.

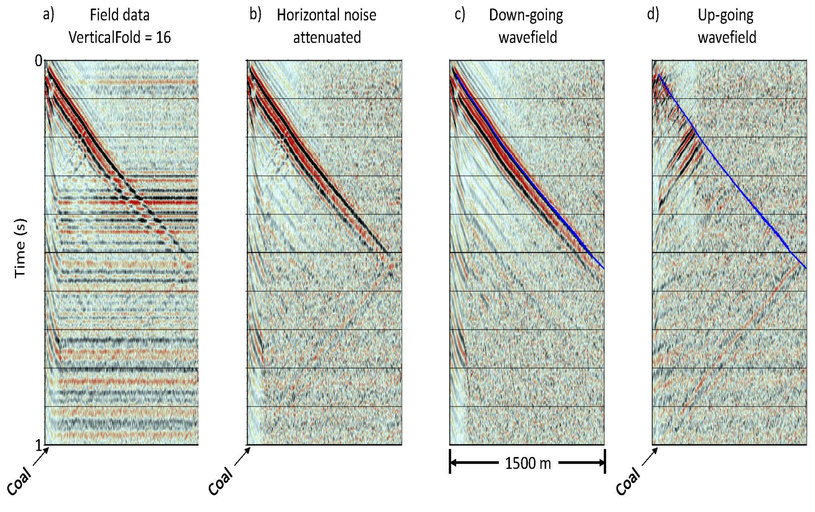

FIG. 3. March VP 2010 field data with vertical fold equal to sixteen (a), after removing horizontal noise bands using a *f-k* filter with 8 km/s cut-offs (b), and the down-going (c) and up-going (d) wavefields separated using *f-k* filters. Displayed with a 500 ms window AGC.

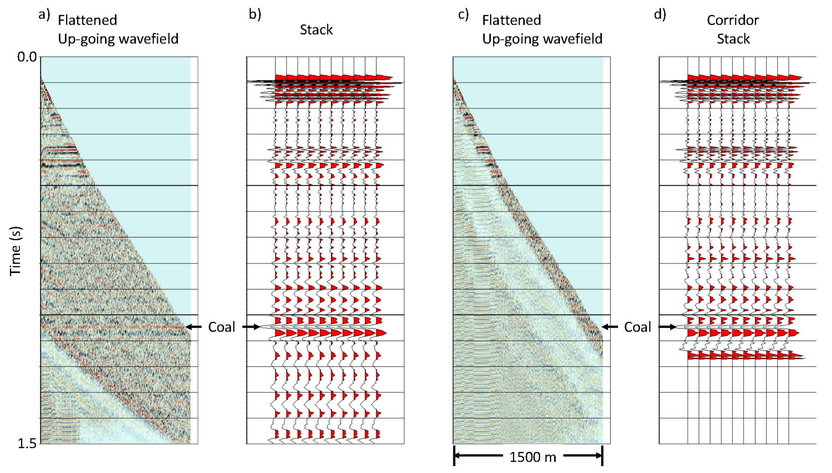

FIG. 4. March VP 2010 field data with vertical fold equal to sixteen after flattening on first-break picks (a) and stacking (b), and after applying a bottom mute (c) and corridor stacking (d). Displayed with a 500 ms window AGC. The stacked trace(s) have been repeated ten times for visibility (b and d).

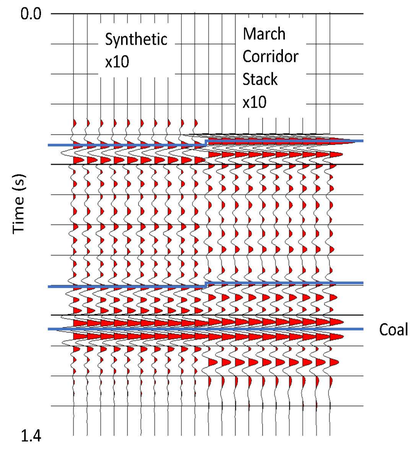

FIG. 5. Initial comparison of a synthetic seismogram (left) to the March VP 2010 corridor stack (right; Figure 4d). Data are displayed with an Ormsby 5-10-25-35 Hz filter and a 500 ms window AGC. The synthetic has been shifted to line up the trough associated with the coal but has not been stretched to better match shallower reflections. The synthetic and stacked trace(s) have been repeated ten times for visibility.

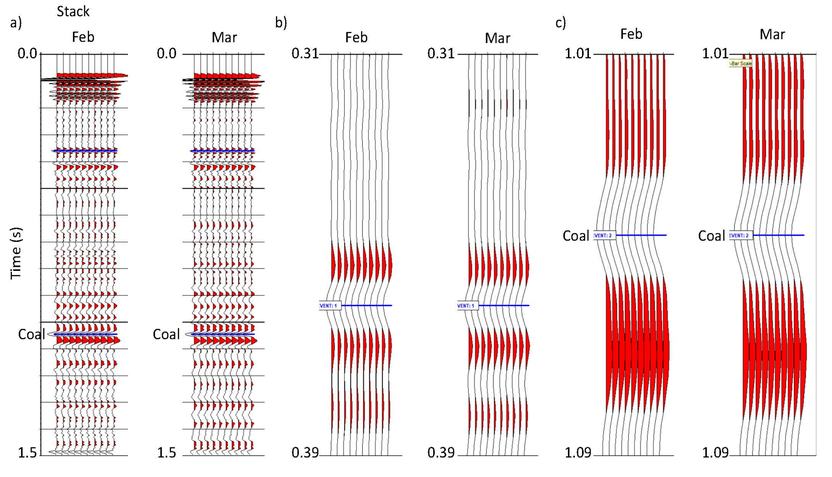

FIG. 6. February (vertical fold = 8) and March (vertical fold = 16) stack comparison (a) 0-1.5 s, (b) (0.31-0.39 s, (c) 1.01-1.09 s. The stacked trace(s) have been repeated ten times for visibility

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