

# High-Resolution Crosswell Seismic Imaging Increases Reef Production 300%

DeepLook-CS crosswell seismic imaging reveals discrete porous zones within a New Mexico carbonate reef

## CHALLENGE

Locate porous reservoir zones between producing wells in the Wolfcamp Formation in New Mexico, USA, averaging 10 to 15 ft thick, which is below the resolution of 3D seismic surveys.

## SOLUTION

Survey with DeepLook-CS\* crosswell seismic imaging service to obtain detailed interwell profiles at up to 100 times the resolution of conventional surface seismic surveys.

## RESULTS

Revised drilling strategy from vertical to horizontal wells to better access the discontinuous nature of the reservoir bodies revealed by the DeepLook-CS service profiles, resulting in a 300% increase in production per well.



## Reservoir hide and seek

Chevron had targeted isolated structural highs thought to be algal mounds in the Wolfcamp Formation in Vacuum field as potential reservoirs. However, the production from vertical wells drilled into the peaks of the structures was lower than expected and did not fit the reservoir model for this type of geobody.

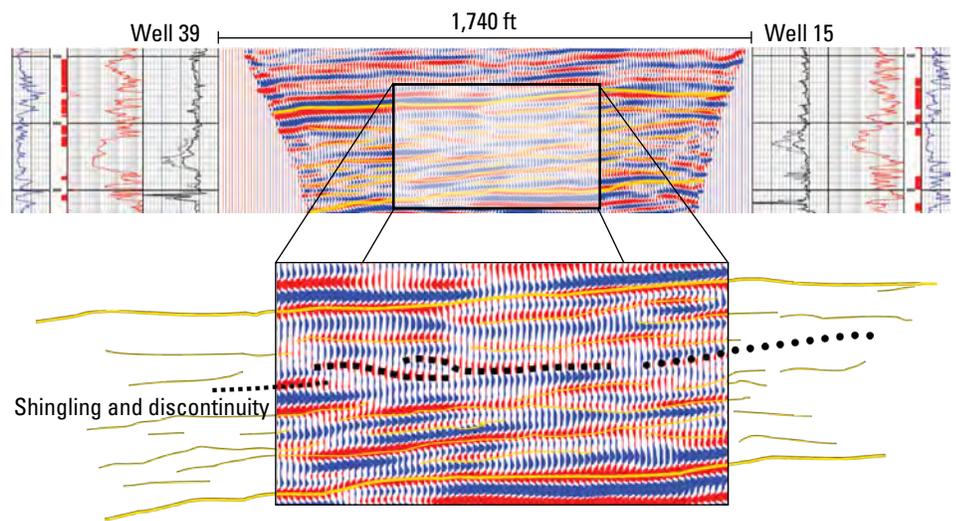
Outcrops of the Wolfcamp are laterally discontinuous, and it was believed that the same situation existed in the subsurface. The challenge was predicting where the reservoir rock was. With the porosity stringers averaging only 10 to 15 ft thick, 3D seismic surveys could not provide sufficient resolution for refining the model and resolving the continuity of the porous zones.

## 100 times surface seismic resolution

DeepLook-CS crosswell seismic imaging service uniquely combines wellbore sonic sources and receivers to provide up to 100 times the resolution of conventional surface seismic surveys. To image reservoir intervals with a vertical resolution of 5 ft, DeepLook-CS service passes specially engineered sonic energy through the zone of interest, from source to receiver in separate wells. Velocity, reflection, and other sonic properties are measured to provide structural and physical characteristics of the zone in both the horizontal and vertical directions.

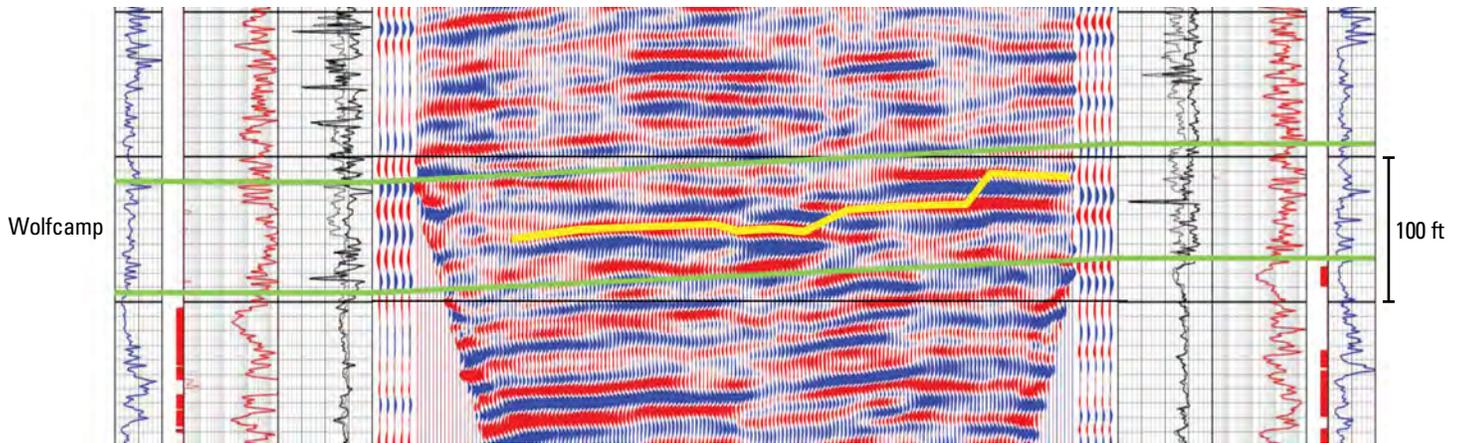
## Crosswell answers

Four crosswell seismic profiles were acquired to further characterize the structure of the algal mounds. The interpreted section clearly shows that the reservoir body is highly discontinuous from well to well. As a result, incomplete drainage of the reservoir was occurring from the vertical well placement.



Discontinuous clinoform features are identifiable in the interpreted crosswell seismic data from the Vacuum field Wolfcamp survey.

## CASE STUDY: DeepLook-CS service crosswell images carbonate reef porous zones, New Mexico, USA



*Horizontal well placement (yellow) was specifically designed to intersect Wolfcamp porosity zones between the clinoforms.*

Climoform features identified in the outcrop as subaqueous landforms are clearly evident in the crosswell sections and provide a good indication of the dip and location of reservoir-grade rock. The presence of the clinoform structures and the other complex features observed in the crosswell profiles suggests a much more complex reservoir than was previously thought. With the amount of compartmentalization observed, clearly vertical wells are not an effective strategy for efficient reservoir drainage. A new strategy was required.

The high-resolution crosswell seismic images were used to revise the reservoir model to account for the discontinuous nature of the Wolfcamp and include structures identified in the outcrop, such as tight streaks, clinoform structures, and pinchout features. A horizontal well drilling program was then launched based on the more accurate reservoir model, with the wells drilled to intersect the porosity zones between the clinoform structures. The strategy is successful: Production from a single horizontal well is more than 300% greater than that from one of the vertical wells.

[www.slb.com/deeplook](http://www.slb.com/deeplook)

**Schlumberger**