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DeepLook-CS Crosswell Seismic Imaging Enhances Subsurface Understanding in Mature Oil Field

Pertamina EP pioneers crosswell seisimc surveying in Indonesia to provide insight for infill development

CHALLENGE

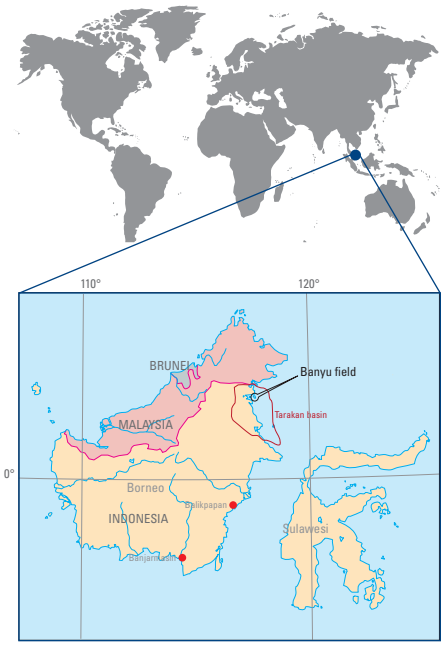
Target new infill drilling areas in a structurally complex field with challenging surface seismic data.

SOLUTION

Introduce DeepLook-CS* crosswell seismic imaging service to conduct tomographic surveying by deploying the source and receivers downhole to avoid the attenuative overburden, resulting in enhanced-resolution images.

RESULTS

Developed new structural and stratigraphic interpretations to support infill development based on a greatly improved understanding of the subsurface from the enhanced resolution of the DeepLook-CS crosswell seismic images.



Poor-quality surface seismic data

Bunyu field offshore east Kalimantan is typical of many mature Indonesian oil fields in that the thick overburden and complex structure obscure the results of surface seismic surveys. Additional obstacles to seismic interpretation are an undulating, shallow low-velocity layer and interbedded coals in the sand-shale reservoir sections. Pertamina EP needed a better understanding of the structure and stratigraphy than surface seismic surveys could provide to plan infill development wells.

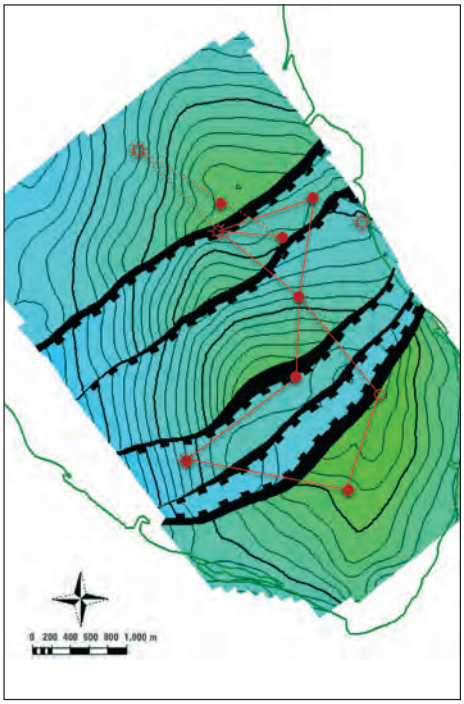
New insight through enhanced resolution

DeepLook-CS crosswell seismic imaging of reservoir layers places the receivers and source in adjacent wells for imaging the interwell volume. Crosswell acquisition for Bunyu field employed a Z-Trac* crosswell seismic P- and S-wave source with a 3-component, 60-level receiver. The various interwell distances meant that the source-point level spacing was set to 7.5 m or 15 m depending on the well separation, with receiver levels at 15-m spacing. The bandwidth ranged from 30 Hz to 120 or 200 Hz. With the downhole source sweeping at 3 to 5 times the surface seismic frequency, the gains in seismic resolution were a vast improvement over surface seismic data.

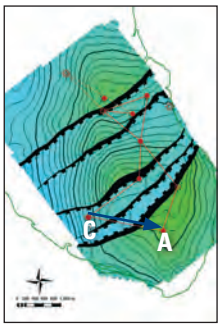
World-record 2-km acquisition separation

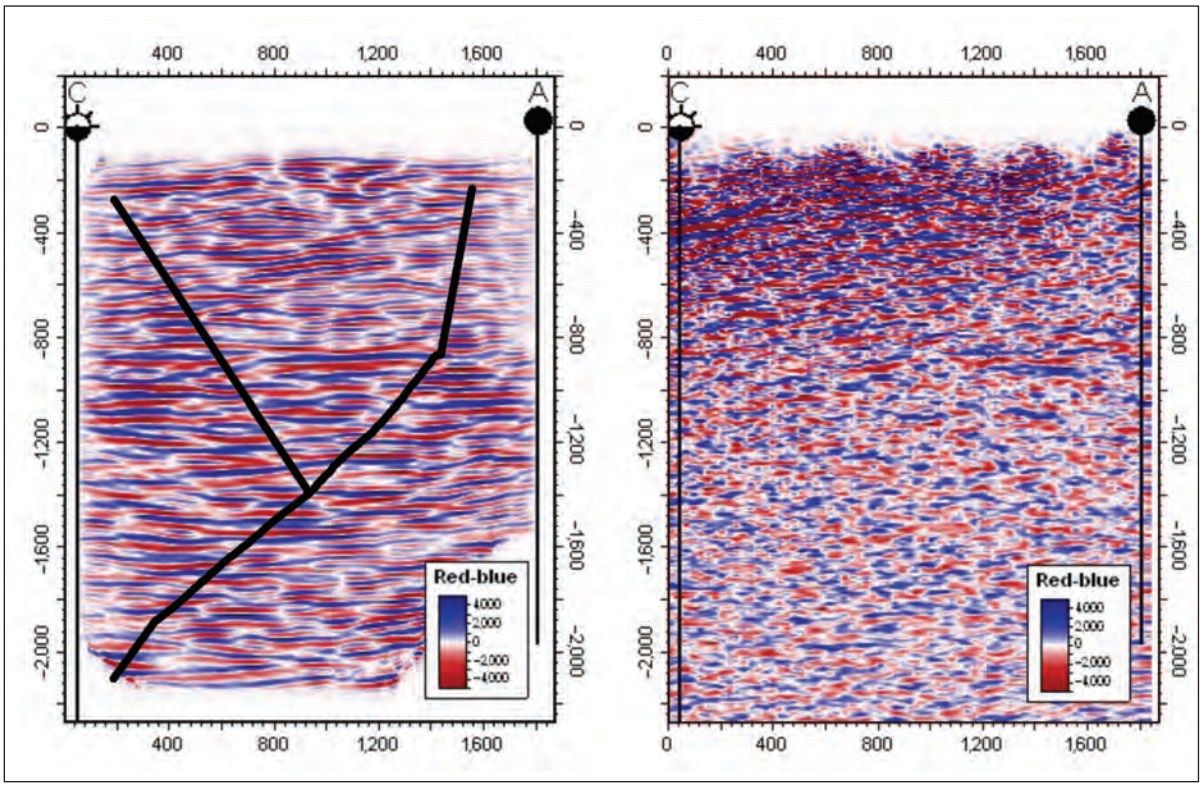
The DeepLook-CS crosswell profiles deliver significant improvement in the seismic imaging of Bunyu field. The images reveal stratigraphic and structural features that were not visible in the existing seismic data. The ultimate reward for Pertamina EP is in locating bypassed pay zones, thus providing significant future potential for this brownfield reservoir.

The project highlighted the capabilities of the new Z-Trac source by setting a world record in crosswell acquisition at 2-km well separation. Excellent reflection seismic data was generated from both P- and S-waves for imaging and interpretation in the highly attenuative clastic formation.



The 11 DeepLook-CS crosswell lines are superimposed on a structure map of Bunyu field.





At approximately 2-km well spacing (from points C to A on the inset map), the DeepLook-CS crosswell seismic image (left) reveals previously unseen structure and stratigraphy, including a new fault interpretation. The surface seismic section is on the right.

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