P-S survey design

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ABSTRACT

Fold, illumination, offset distribution and azimuth distribution were evaluated for PS survey design for two different projects. The first was planned to image an interval of interest from 380 m to 425 m depth, for the Paskapoo Formation, located in the Priddis area. Orthogonal and slant geometries were tested with different parameters. Good results for the converted wave 3D design were found using a slant geometry design with receiver interval and source interval of 10 m, a receiver line interval of 50 m, a source line interval of 25 m and a maximum offset of 400 m. Fold for the slant geometry design gave better offset and azimuth distributions than the orthogonal geometry design. Illumination was similar in both types of geometries. This design was done using CREWES QuadDes software.

A second case study was undertaken where orthogonal and slant designs were also both tested for a project area with a deeper target, at 2160 m depth, and a shallow horizon of interest at 500 m. After the analysis, an orthogonal geometry design was chosen with 360 m source line interval, 240 m receiver line interval and 60 m source and receiver station intervals. The patch selected was 26 lines with 100 receivers per line to have an aspect ratio of about unity for optimum data inversion. This design was undertaken using OMNI software.

CASE STUDY 1: SHALLOW TARGET

For orthogonal geometry, the requirement of fold is accomplished but a horizontal pattern of low and high values of fold is noticed in the P-S design. The offset distribution diagram produced the footprint effect of the surface lay out and the azimuth distribution showed irregularities in the P-S results compared to P-P results (figure 1).

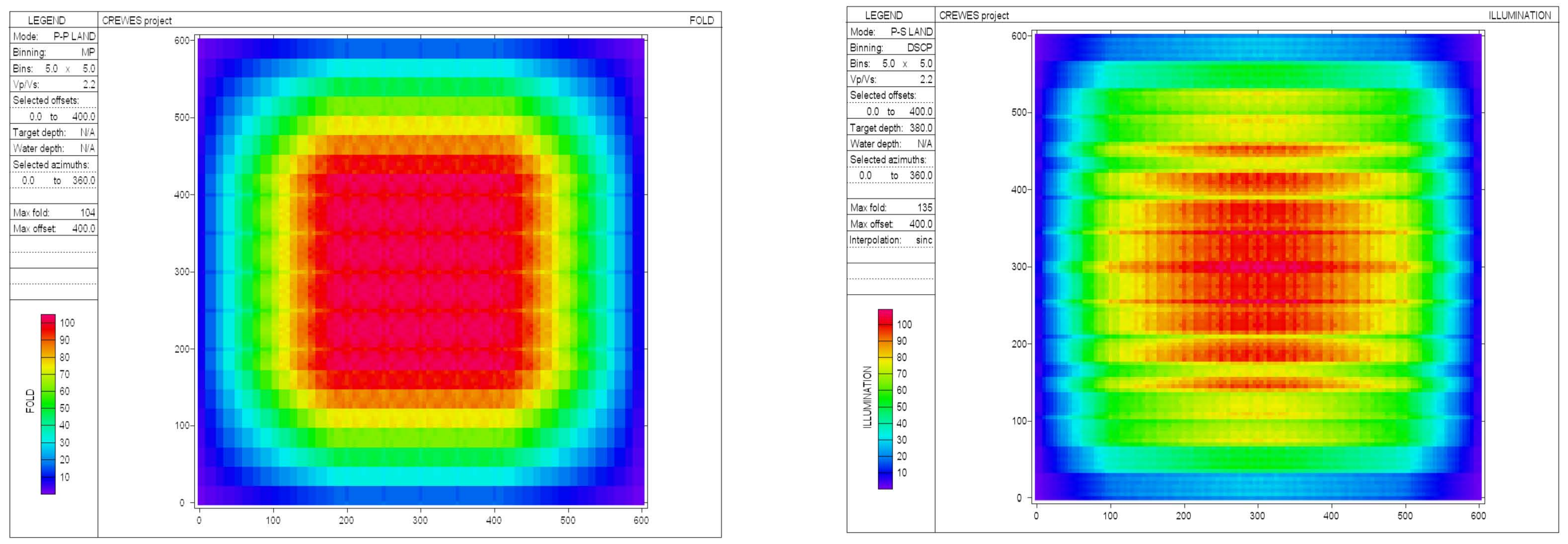

FIG. 1. Fold – Orthogonal geometry. P-P survey design (left) and P-S survey design (right). .

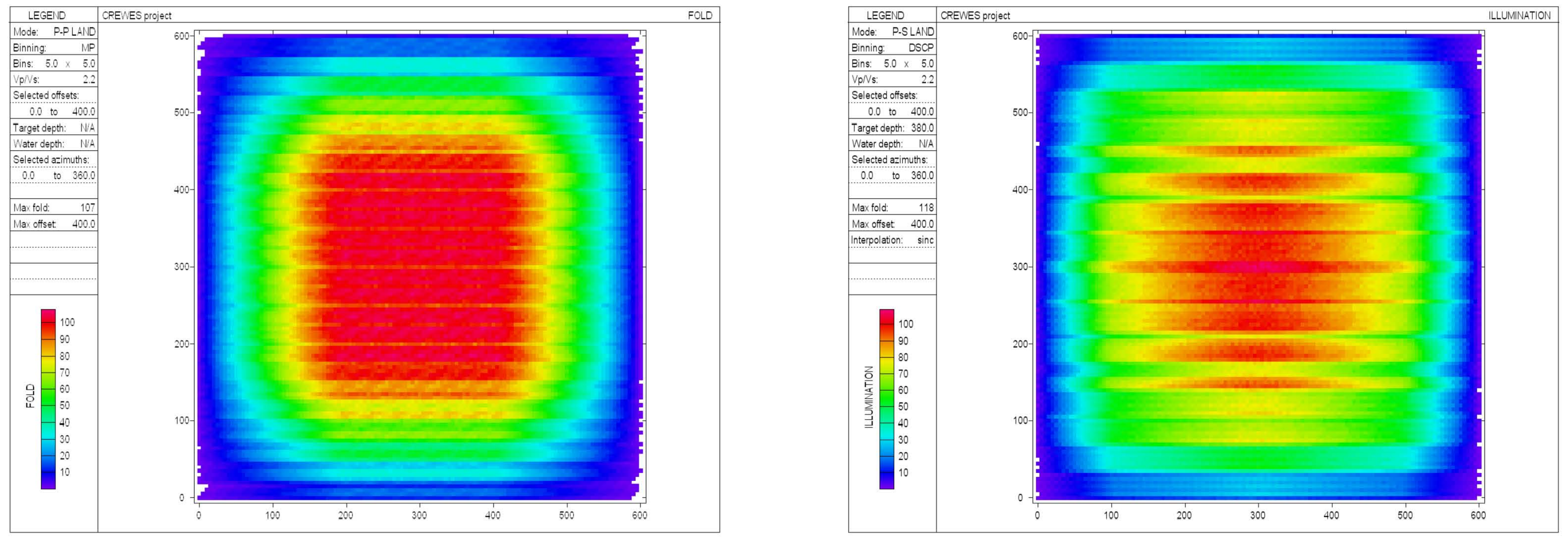

FIG. 2. Fold – Slant geometry. PP survey design (left) and PS Survey design (right).

For slant geometry, the fold reached the required value but with the same horizontal pattern of low and high values of fold. The offset and azimuth distribution showed better response than for the orthogonal geometry, being closer to the P-P survey design (figure 2).

CASE STUDY 2: DEEP TARGET

The main objective was to analyzed geometry footprint especially for the PS survey design. This effect can be appreciated in the slant layout for the PP survey design, especially around the lake; both geometries show the layout of sources (east-west) because some segments of these lines were moved to old cut lines (figure 3).

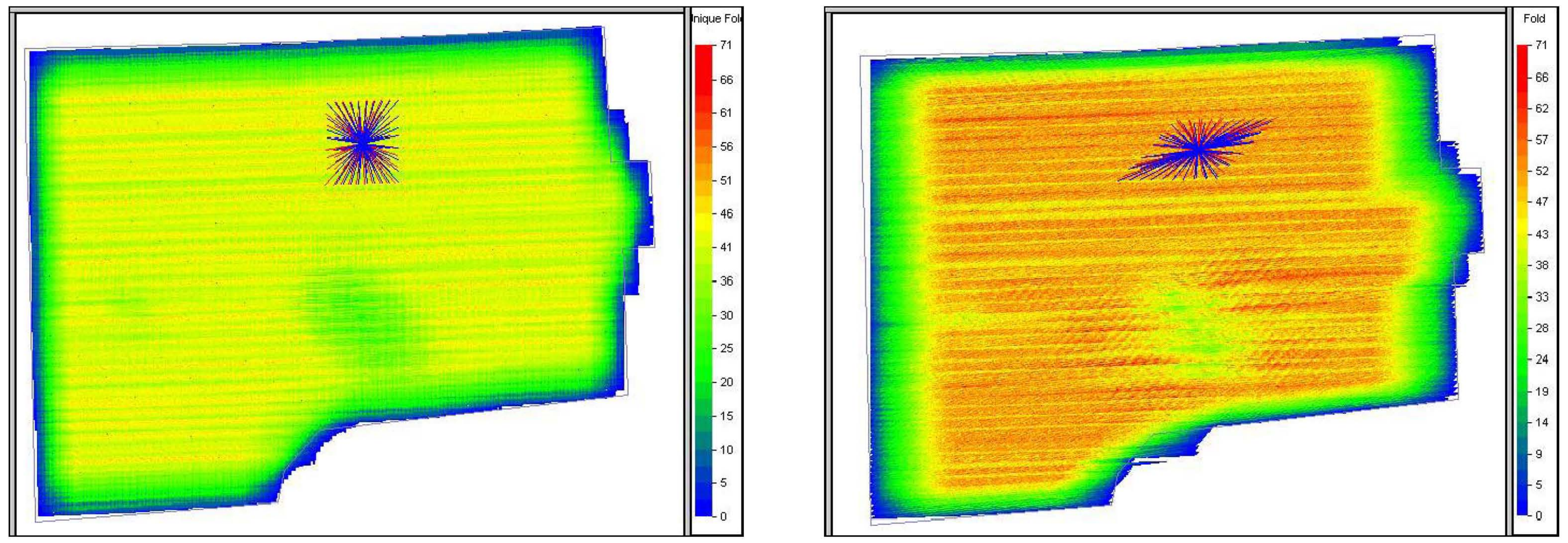

FIG. 3. PP survey design fold. Orthogonal geometry (left) and slant geometry (right)

In the PS survey design, the footprint of the surface layout is slightly stronger for orthogonal geometry. Regarding the lake footprint, there is a transition zone from the lowest values inside the lake to the highest values of fold outside the lake for the slant geometry. For the orthogonal geometry this change from lower to higher fold is more abrupt (figure 4).

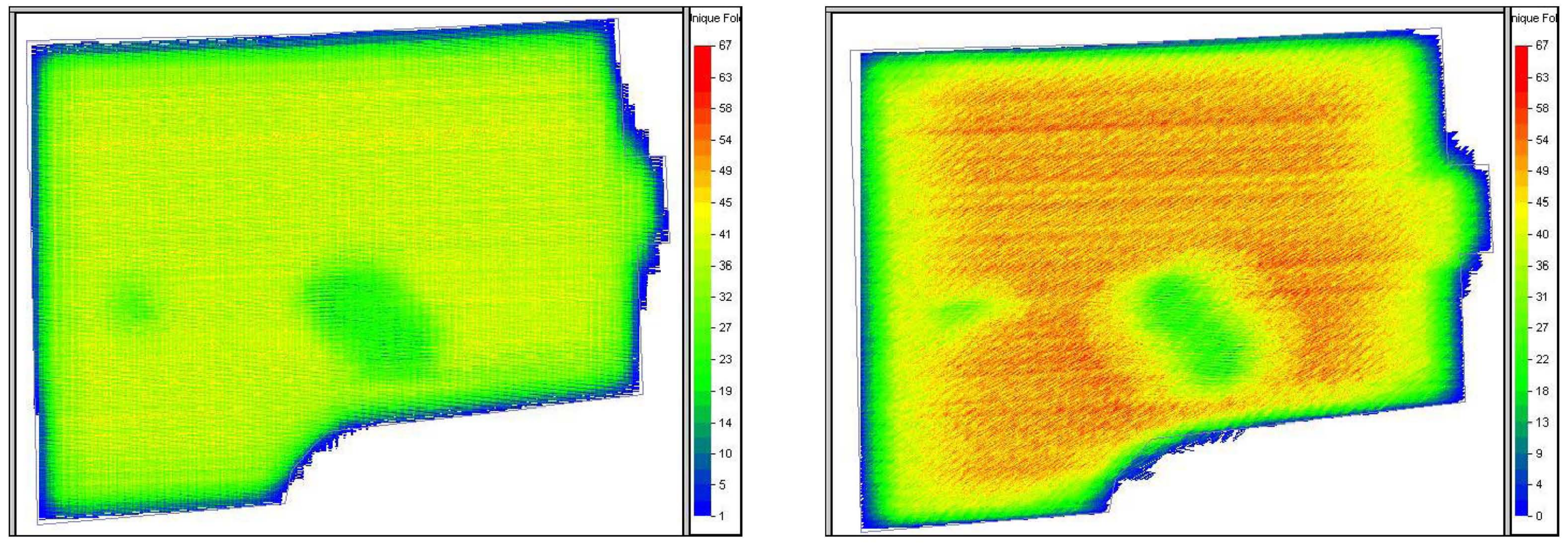

FIG. 4. PS survey design fold. Orthogonal geometry (left) and slant geometry (right)

CONCLUSIONS

- PS surveys can be designed in such a way that can give good attribute results, similar to PP surveys and this will let us take advantage of the new application of the PS surveys.
- Decreasing source line interval improves the seismic attributes (fold, offset and azimuth) with the consequent increase in survey cost. A design optimization can be made to balance quality requirements with cost.
- Decreasing receiver line interval improves the horizontal discontinuities of fold (case study 1).
- For the shallow target, the design gave better attribute distribution when considering slant geometry.
- For the deep target design, orthogonal geometry was chosen because it produced better seismic attribute distributions than the slant geometry. The acquisition geometry footprint produced by the orthogonal geometry can be improved by optimizing design parameters, especially the receiver line interval.

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