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Use of Antrack Volume in Horizontal Well Placement

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Summary

Fault interpretation in seismic volume is a tedious and time consuming process and varies from interpreter to interpreter. Accurate Fault interpretation method is not only useful for preparing a better geocellular modeling and calculating volumetrics etc. but also becomes most crucial for horizontal well placement.

The authors have utilized the antracking module available in the Petrel software to generate antrack volume for delineating the fault network especially the sub-seismic fault which becomes impossible to interpret manually in their project area. The antrack workflow available in the petrel software utilizes a series of attributes to generate the antrack volume.

Later on this antrack volume was utilized for horizontal well planning and placement. The wells planned and drilled based on the antrack volume were completed successfully with no or minimum complications.

Introduction

The study area is located in the deep waters of the East coast of India. The field is charged with both oil and gas and is currently under development and production stage. Currently the development activities are being carried out for oil production mainly from horizontal wells.

In the first phase of drilling campaign two horizontal wells (A and B) were drilled while the well A was completed successfully the well B encountered severe mud loss during drilling and had to be terminated before the planned target depth. It was then assumed that the well must have encountered a fault zone, but it was difficult to identify the fault zone in conventional seismic (Figure.1) as well as other attributes like coherence and semblance. At this stage, it became important to have a detailed study on the faults, as future wells planned in this area should not face such risks.
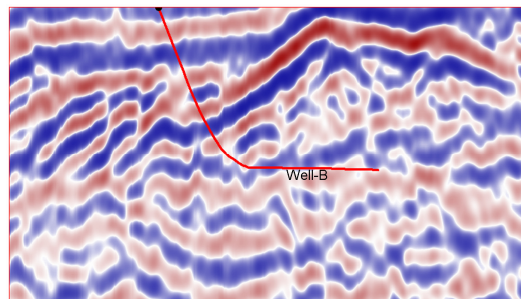

Figure.1: Seismic Section along well B

Hence, the antrack volume was generated using the petrel software to delineate the subseismic faults in the area and is being used for future well placement.

Theory

The antrack process as it names says is based on the way the ants do their task such as finding food and building nest, they use swarm intelligence for this purpose. While searching for food ants use pheromone trails to guide other colony members to food they have found. This gives them the efficient path from nest to food. Similarly the antrack process in Petrel uses similar ants (computer programmed

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agents) to follow discontinuities. Swarm intelligence can be used to identify, track and sharpen faults (Pedersen et al., 2002).

The general workflow (Figure.2) and process applied for the generation of Antrack volume include the preconditioning of the depth converted seismic data (Figure.3) by structural smoothing (Figure.4) followed by making attribute like chaos or variance to for delineating discontinuities. Finally chaos (Randen et al., 2000) or variance (Van Bemmel and Pepper, 2000) attribute generated is utilized to generate the antrack volume by the computer agents which are programmed to follow the desire faults avoiding the noises. In this work Variance cube (Figure.5) was utilized for generating antrack volume (Figure.6).

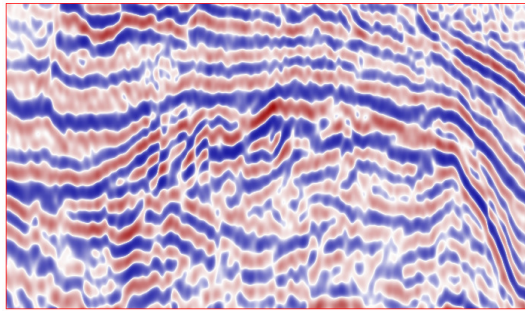Figure.2: General workflow for preparing Antrack volume.
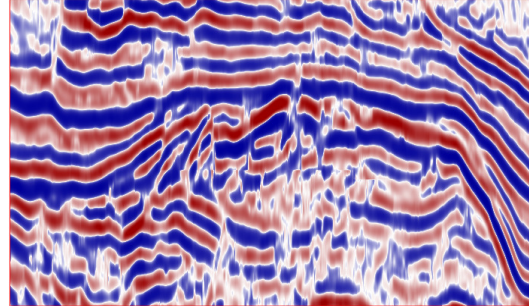

Figure.3: Depth converted Seismic Section

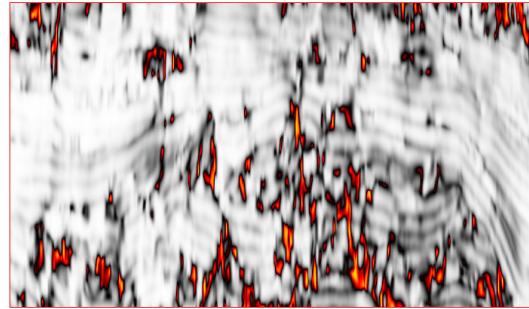Figure.4: Above Section after applying structural smoothing.

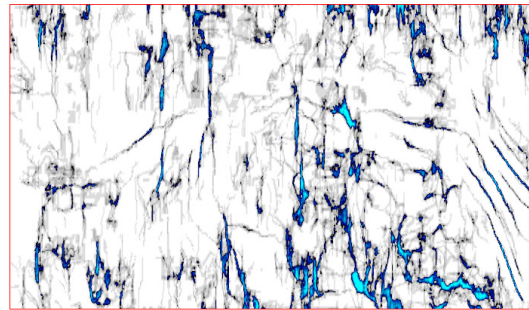Figure.5: Section showing the variance attribute.

Figure.6: Section showing the Antrack attribute.

Discussion

It was observed in the antrack volume that the well B which had to be terminated due to severe mud loss indeed went along a fault zone and was grazing along it (Figure.7 and Figure.8). The similar feature was impossible to identify in variance cube. (Figure.8)

The future well aftermath this experience was planned orthogonal to the faults to avoid mud losses during drilling. The antrack volume helped to predict the possible depth at which the faults will encounter prior to drilling. The well C was planned based on the antrack and was successfully drilled with no complications. It was also observed that the faults encountered at or near the depth in which they were predicted in this well.
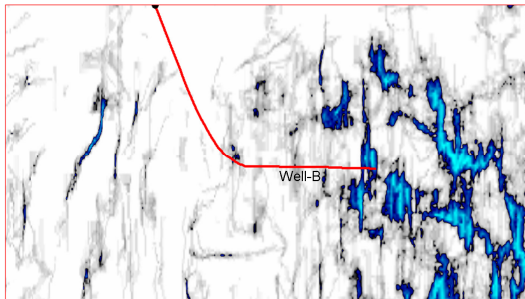

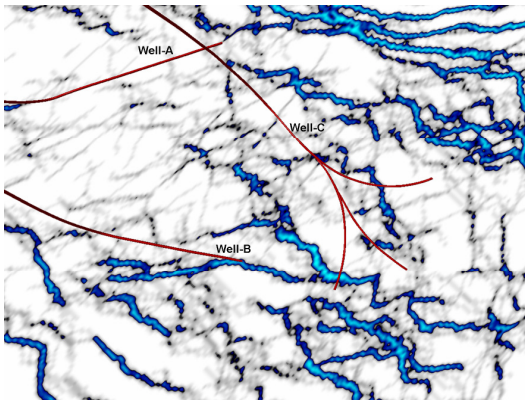Figure.7 Antrack Section along well B.

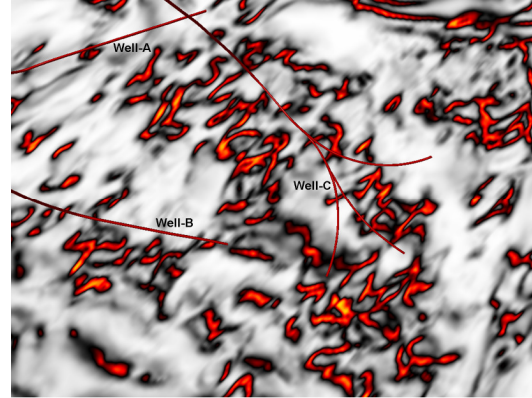Figure.8 Showing Antrack Slice with the horizontal wells.

Figure.8: Showing Variance Slice with the horizontal wells.

References

Pedersen, S. I., Randen, T., Sonneland, L., and Steen, O., 2002, Automatic 3D Fault Interpretation by Artificial Ants: 64th Meeting, EAEG Expanded Abstracts, G037.

Randen, T., Monsen, M., Signer, C., Abrahamsen, A., Hansen, J. O., Saeter, T., Schlaf, J., Sonneland, L., 2000, Three-Dimensional Texture Attributes for Seismic Data Analysis: SEG Annual International Meeting Expanded Abstracts 19, 668.

Van Bemmel, P. and Pepper, R., 2000, Seismic Signal Processing Method and Apparatus for Generating a Cube of Variance Values: United States Patent 615155.