Reprocessing for Improved Fractured Basement Imaging

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Abstract:

Fractured basement has long been known as a viable reservoir rock for hydrocarbons as a result of weathering during subaerial exposure. Many of these fractures are below seismic resolution and cannot be directly imaged. Seismic attributes such as dip azimuth and most positive curvature must therefore be used in order to infer the presence, location, and direction of fractures and fracture systems. In this study area, the use of AASPI derived attributes to analyze the data has proceeded concurrently with ongoing efforts to reprocess the data for improved imaging and suppression of the acquisition footprint.

Data Quality:

The quality of the data is severely hampered by a strong acquisition footprint which overprints the entire study area. Footprint suppression is being performed with the goal of increasing both seismic resolution and the confidence of interpretations made from the data. Figure 1 shows a time-slice of the Sobel Filter Similarity through -X522 ms demonstrating the severity of the footprint.

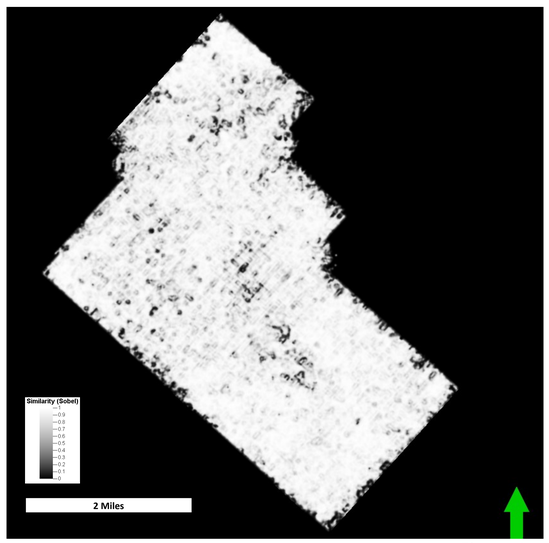

Figure 1

Analysis:

Attributes were derived from the seismic data using the AASPI software and applied to image subtle features within the data. Figure 2 shows Sobel Filter Similarity through a horizon slice about 50 ms below the top of the basement, with a possible fault shown by the yellow arrows. Figure 3 shows Dip Azimuth through the same horizon slice. The yellow arrows show the same feature seen in Figure 2, along with some other features trending in the same direction. North-South trending features can be observed as well, and are shown by the blue arrows. The Northeast-Southwest and Northwest-Southeast features are acquisition footprint, as well as the feature shown by the red arrows. Figure 4 shows the Dip Magnitude through the same horizon slice as Figure 2. The North-South trending features can be seen well, as shown by the blue arrows. The features in the southern part of the survey are not as well imaged. Figures 5 and 6 show k1 Most Positive Curvature and k2 Most Negative Curvature respectively, through the same horizon slice as in Figure 2. Some of the features observed in the southern part of the survey appear very well defined in Figure 6, and somewhat less so in Figure 5. Broader zones of high curvature can be seen for the North-South trending features, as shown by the blue arrows. Figure 7 shows a basement structure map derived from magnetic data, with the approximate location of the survey shown.

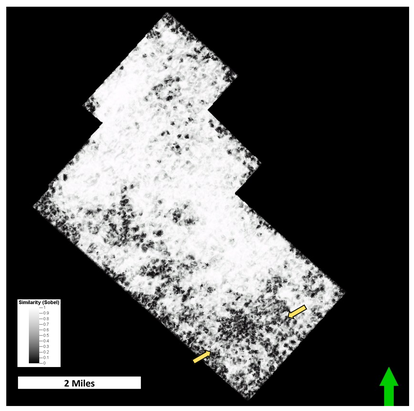

Figure 2

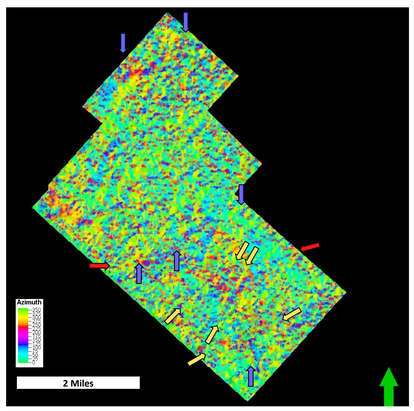

Figure 3

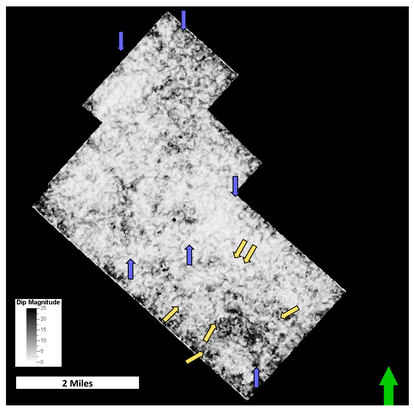

Figure 4

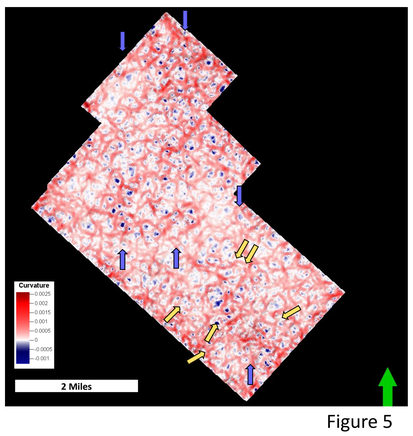

Figure 5

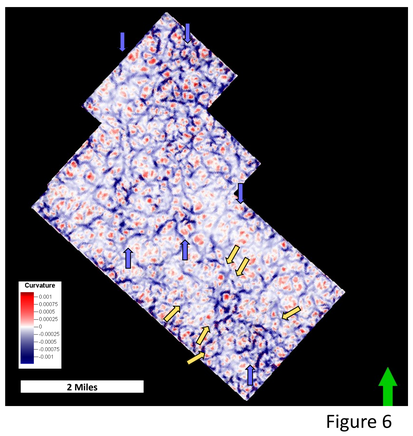

Figure 6

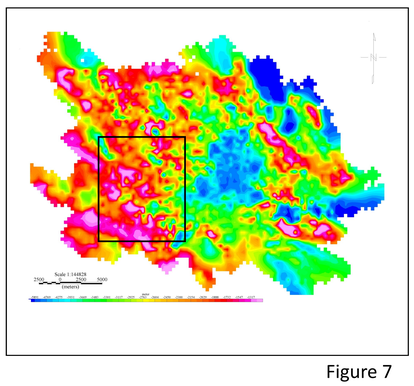

Figure 7

Conclusions:

The right attributes can be used to successfully image faults that would otherwise be below seismic resolution, though acquisition footprint on the seismic data can obscure much of the information required to properly interpret these features. In the study area, any features parallel to the footprint would likely be obscured due to its strength and could not be interpreted with any level of certainty. Features oriented in other directions can be detected under the right conditions; however they still suffer from interference with the acquisition footprint.

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