The unique seismic processing and imaging experience with fascinating data from Onshore Trinidad.

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Introduction

In a complex structural setting accumulated learning and knowledge about the area and the data are both extremely important and vital to the overall success of the processing and imaging project. The GeoVectra team successfully went through a very steep learning curve over several months during the pilot processing work of onshore Trinidad data. The knowledge gained was tremendous and was fully and successfully employed for the processing of additional 2D and 3D data from the same area. A strong focus was given to thorough velocity work, statics, preservation of dips and refinement of the complex structural features.

The prime objective of this project was to generate a subsurface image as true as possible in this extremely complex and intensely deformed basin.

Theory and/or Method

The uniqueness of the datasets was such that many well known algorithms from the processing tool box would not work well on these data. It took a careful layer stripping approach to the processing sequence and often felt like "one step forward, two steps back". The unique complexity of this dataset led to the situation where as soon as you thought you had grasped the essence of this processing, the data would reveal something unexpected, requiring another round of testing and concept verification.

We had a long list of proven techniques that would not work on this data and a very short list of what actually gave us a nice consistent result.

We took several learnings from the original pilot work, listed below, and applied them successfully to the new datsets from the same area.

- a good understanding of the data and structure through the processing and imaging work
- optimization of the processing sequence for both the 2D and 3D work
- elimination of those noise attenuation techniques harmful for this particular seismic data
- incorporation of the specifics of the data acquisition into the processing sequence
- optimization of the migration parameters and the imaging approach
- revealed major existing and potential complexities in the data and optimal ways to address them
- confirmed the critical importance of imaging velocity work
- provided a benchmark and reference point for future imaging work

What became obvious from this processing and imaging work was that a fine balance needs to be maintained between keeping consistent velocity trends while allowing variations where necessary. This is true for both structural and imaging velocity updates. An initial RMS velocity profile was derived from a few wells in the area, this data was also useful in identifying the range of interval velocities. During the velocity update work we confirmed that, for this type of data, while seismic can sometimes be picked with largely varying trends, these drastic velocity variations can result in unstable migration results and therefore

should be carefully analyzed and justified. The presence of conflicting, and at times contradicting, dips is the main factor responsible for such high velocity sensitivity. This is an apparent phenomena, but extremely critical to take into account while performing velocity analysis work. Failure to understand this would result in either a too smooth and "safe" trend, leading to the masking of many structural features, or to the velocity field being varied too sporadically, leading to unstable migration results. This is not a trivial exercise and practice and experience in picking this particular data is the key enabler to a successful update. We refined the megamerge velocity grid several times before we were completely satisfied with the result.
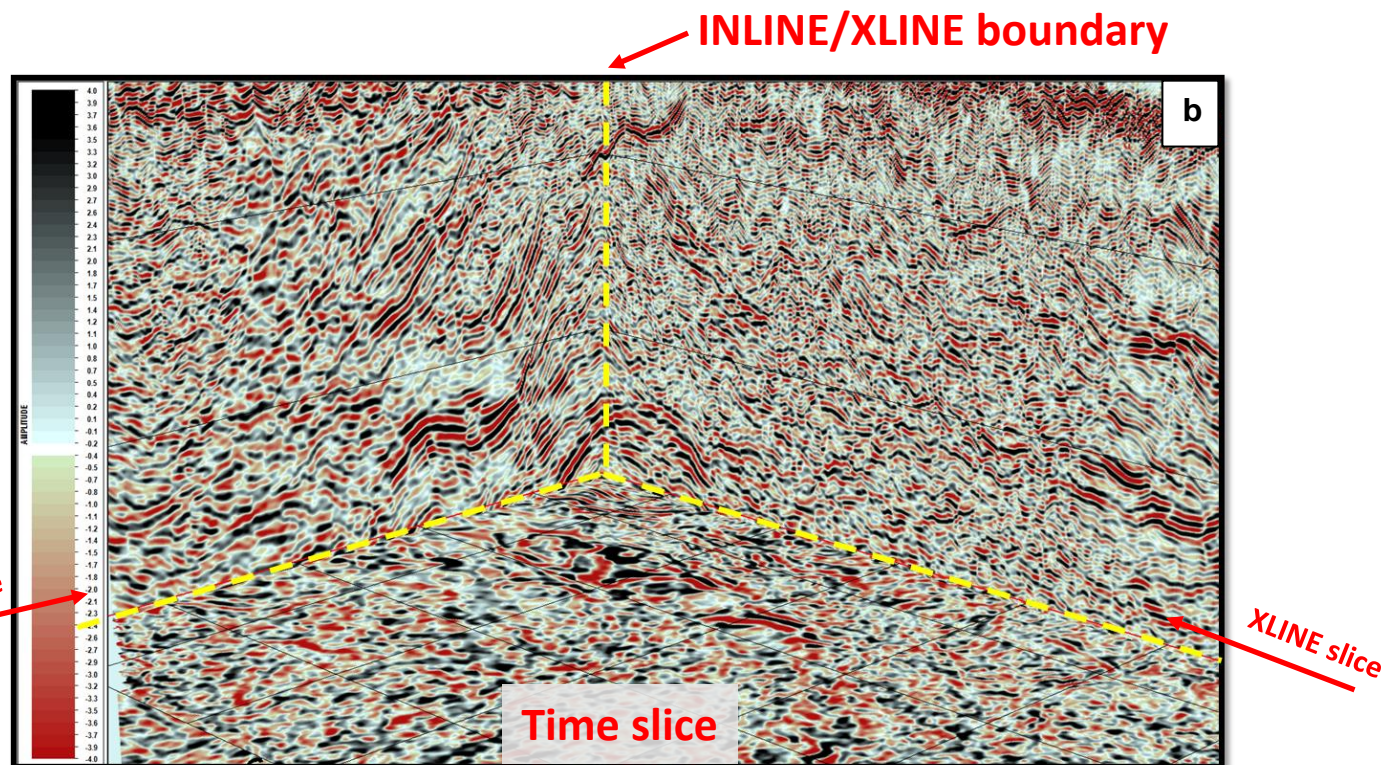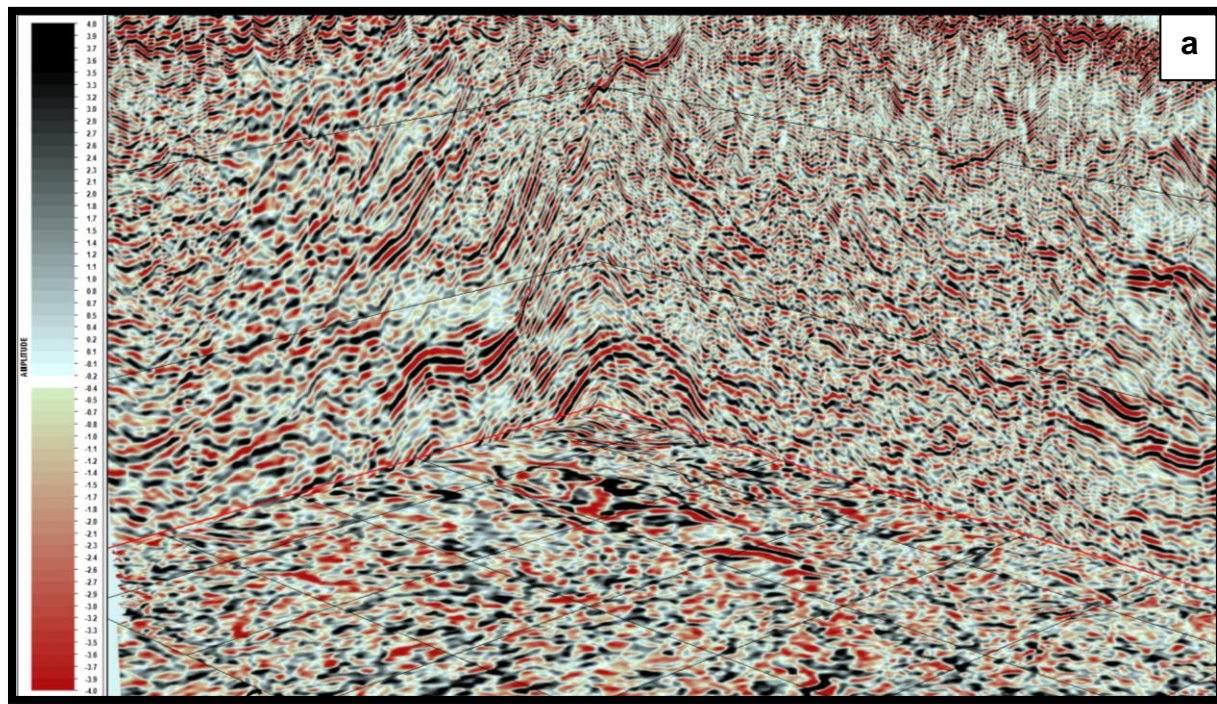
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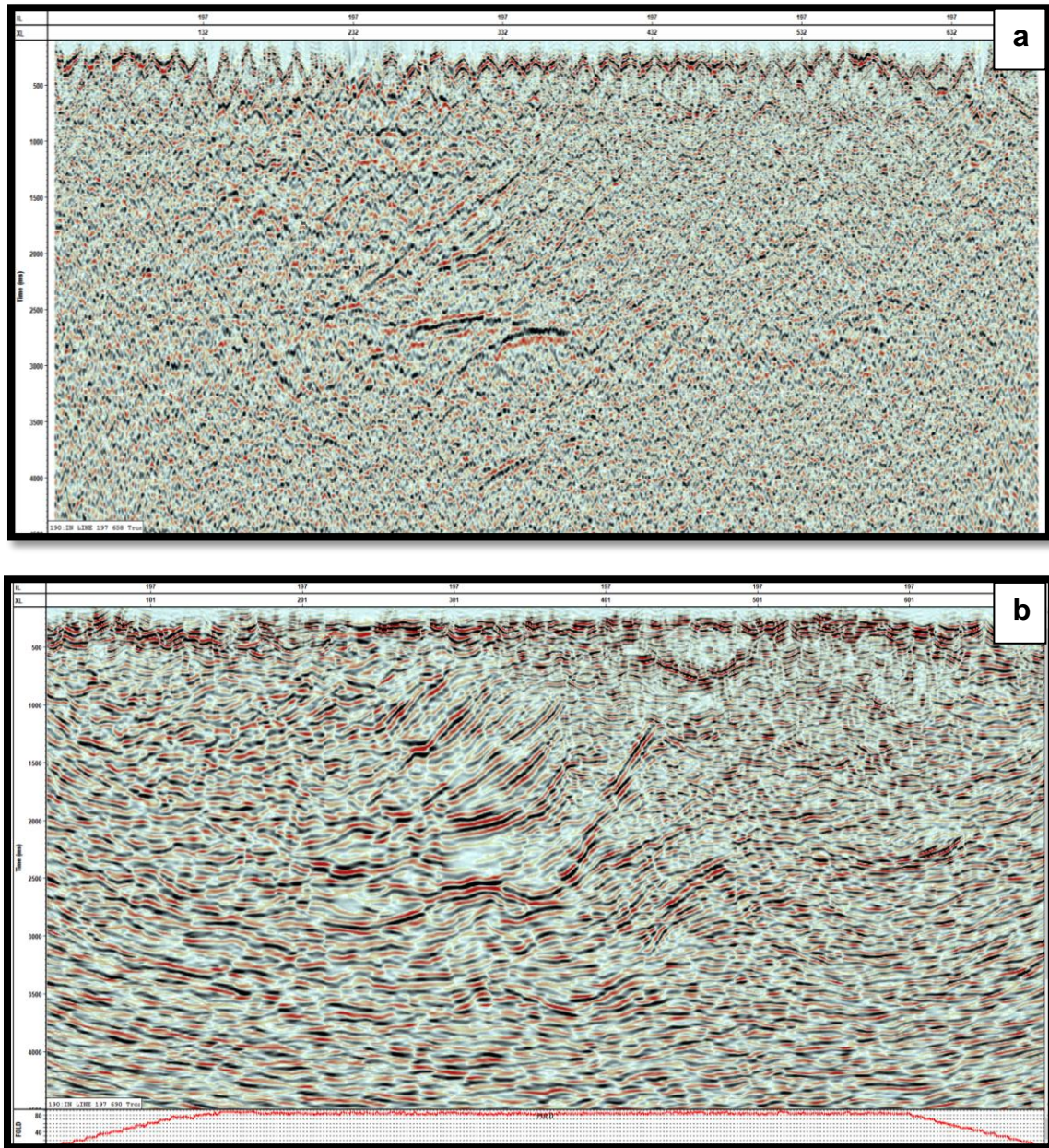
Figure 1.   **a)** Brute structural stack – poor S/N, slight hints of structure.
b) Final PSTM Stack – well imaged steeply dipping structure

An illustration of 3D imaging continuity in the ILINE/XLINE planes. Cover (b) and find the vertical boundary in (a)

Figure 2. a) 3D slice through the Final PSTM volume. Illustrating the 3D structural imaging continuity in INLINE and XLINE directions **b)** 3D slice through the Final PSTM volume with the plane dividing boundaries marked

Conclusions

These are just some of several learnings and observations from this work. More detailed review and analysis will be included in the presentaion.

Working in parallel on 2D lines as well as on the large 3D volume placed some additional strain on the processing group. At the same time, having the 2D data to work on prior to the 3D proved to be extremely beneficial as the following aspects of the processing work were analyzed and addressed setting the best position for processing of the main megamerge 3D volume:

- additional knowledge of the area and structure
- the best approach in handling statics and velocity work
- the processor's eyes were trained on the main structures refined through the 2D work
- velocity refinement techniques
- a workflow that was optimized through 6 iterations of processing the 2D lines
- general knowledge gained from the 2D aspect of the same areal coverage
- various important concept verifications in a simpler 2D setting
- the ability to compare back to the final 2D section while working on the earlier stages of the 3D processing

This integrated approach yielded a much improved imaging result for both 2D and 3D datasets.

Another important aspect of this work was that this was a tremendous learning and development opportunity for both experienced professionals as well as new emerging professionals from both Canada and Trinidad.

This work was extremely challenging and yet rewarding as we went from the brute stack that contained little signal to a final migrated section with a lot of character, structure and complexity.

We are grateful to our Trinidadian colleagues for the opportunity to work on this unique dataset. We truly enjoyed our collaboration with our colleagues overseas while working on this project.

Acknowledgements

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References

Please direct your questions and obtain additional references from GeoVectra Ltd.

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