Optimized Workflows for Integrated Seismic Evaluation of Play Fairways using Visualization and Advanced Stratigraphic Interpretation tools: Examples from Gulf of Mexico, Nigeria and offshore Canada.

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Summary
A major task for 3D explorationists is to devise an efficient process by which critical information can be quickly and reliably extracted from the 3D seismic data and related to earth models. Proper data preparation, volume visualization and data analysis in a collaborative setting is essential if 3D seismic data is to be fully utilized with the most information being extracted in the shortest amount of time to evaluate play fairways.

An interactive presentation will illustrate workflows in a collaborative setting, combining conventional stratigraphic analysis with volume visualization techniques to evaluate play fairways. The computing environment utilized to optimize the workflows in the interactive demonstration will include Stratamagic, VoxelGeo and Geoquest software packages running on Sun and SGI platforms. To illustrate the process, large volumes of Veritas DGC non-exclusive 3D seismic data from the Gulf of Mexico, offshore Nigeria and offshore Eastern Canada will be examined. The main steps of the integrated workflows include, fast track visualization techniques to define intervals of interest, transferring data between applications, selecting and interpreting reference horizons, creating and analyzing horizon slices, and making use of interpretations to manipulate volume data for additional visualization analysis.

The workflows are designed with the objective of high-grading and uncovering subtle, previously undetectable, details in 3D seismic data that reveal key geologic information needed for evaluating play fairways, seismic facies, stratigraphic features and fault patterns which can then be used as preparation for prospect generation and reservoir characterization. Visualization in a full volume context provides the fastest preliminary analysis and understanding of subsurface geology. Then, using advanced indirect mapping methods based on reference horizons, rapid assessment of large seismic surveys can be accomplished yielding an enhanced understanding of the complex geological environments represented within the data. The advanced interpretation tools and visualization techniques used in the workflows can significantly enhance the information extracted from a data volume and notably shorten the time required for geologic evaluation and interpretation. This presentation also makes clear that proper data conditioning and advanced workflow preparation is essential for conducting successful collaborative work sessions that will greatly increase the interpreters efficiency and subsequent understanding of subsurface geology.

Several examples of images resulting from fast track visualization and stratigraphic work sessions are shown below. Figure 1 illustrates an example of a deep channel in the Gulf of Mexico. The channel occurs around four seconds in the data and can only be seen by using thin slab and opacity filtering techniques that emphasize the non-reflective subtle event associated with the channel geometry. Figure 2 and figure 3 are images which illustrate the differences seen when stratigraphic interpretation information is used to condition or flatten a volume during a visualization work session. The Image shown in figure 2 was produced using fast track visualization, where play fairways associated with complex channel systems were identified. The image shown in figure 3 illustrates the changes seen in the same target zone after the data volume was flattened on a horizon generated in Stratamagic. Figure 4 is an example of Offshore Nigeria where fast track visualization techniques were used to image an extended channel system. Figure 5 shows a detailed stratigraphic interpretation in the Deep water Gulf of Mexico where a Debris flow and channel levee system are clearly extracted from the data. Figure 6 is a 3D image of surface exported from Stratamagic and enhanced using VoxelGeo to illuminate fluvial deposits and channel levee system.

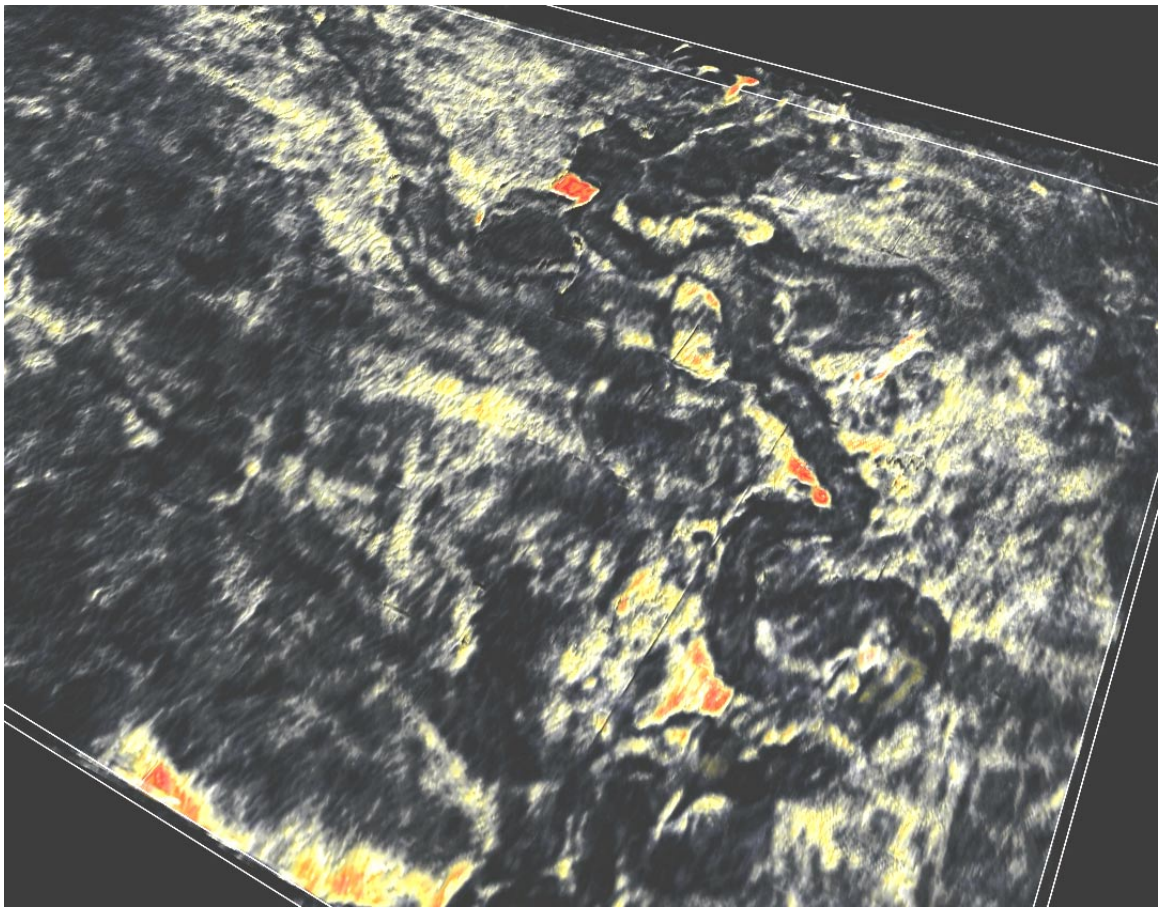

Figure 1: Image produced during a fast track visualization session showing a channel system in the Gulf of Mexico. Channel geometry is characterized by non-reflection zones in migrated data volume, and is enhanced using thin slab and opacity filtering techniques..

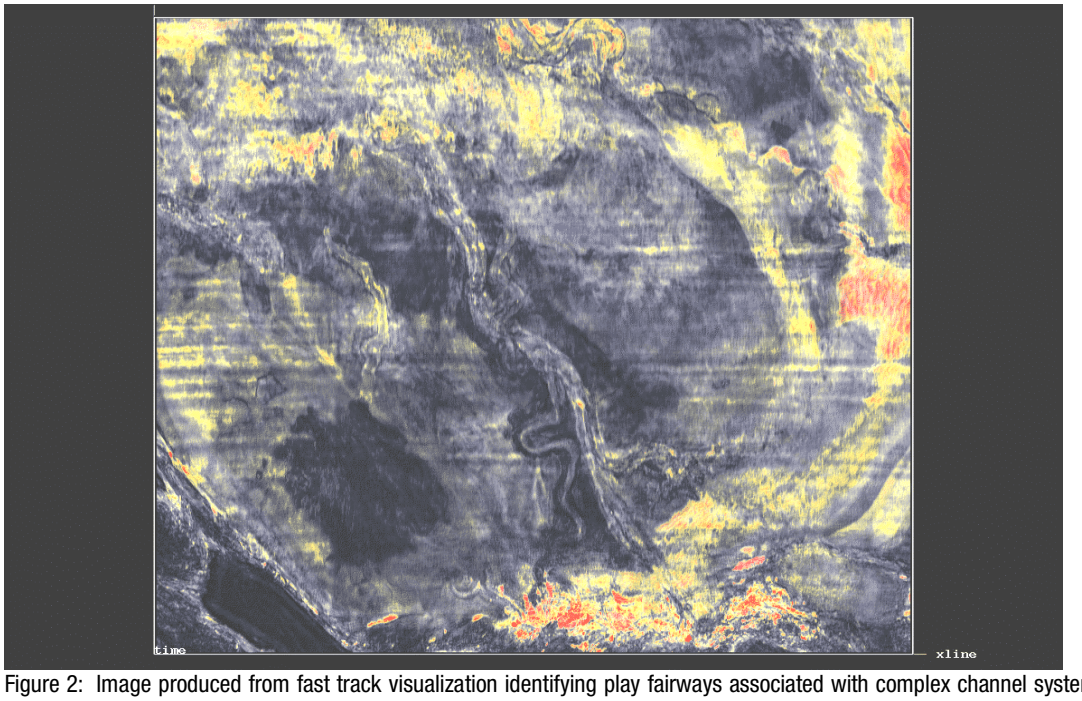

Figure 2: Image produced from fast track visualization identifying play fairways associated with complex channel systems. Image produced using thin slab and opacity filtering techniques in VoxelGeo.

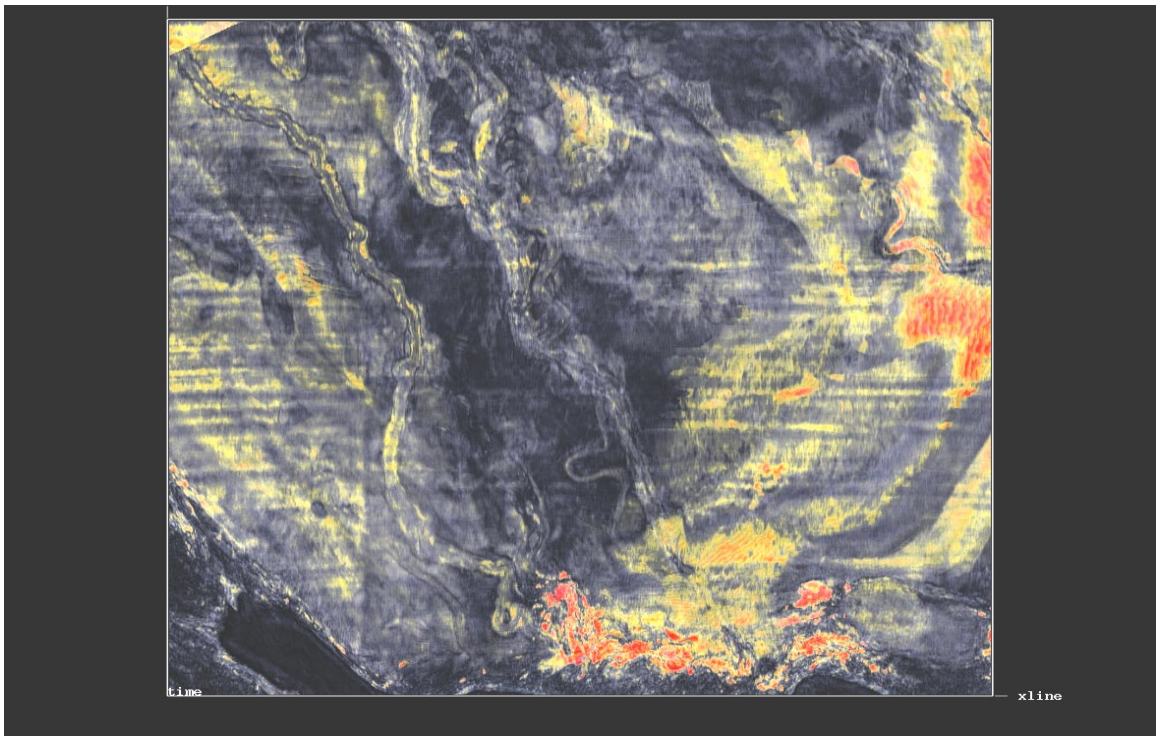

Figure 3: Enhanced representation of figure 2 produced using visualization techniques where volume manipulation was applied using reference horizons generated with Stratamagic

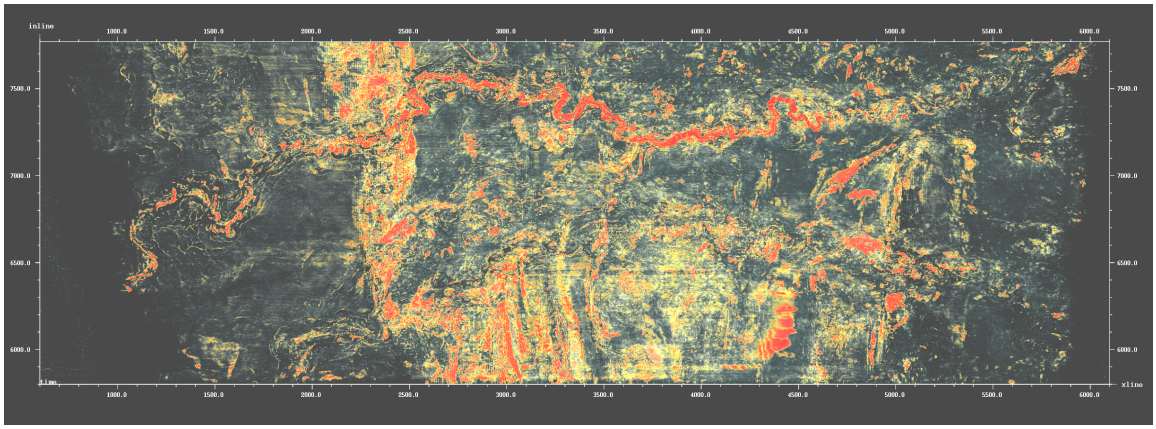

Figure 4: Offshore Nigeria Image produced using fast track visualization techniques showing extended channel system.

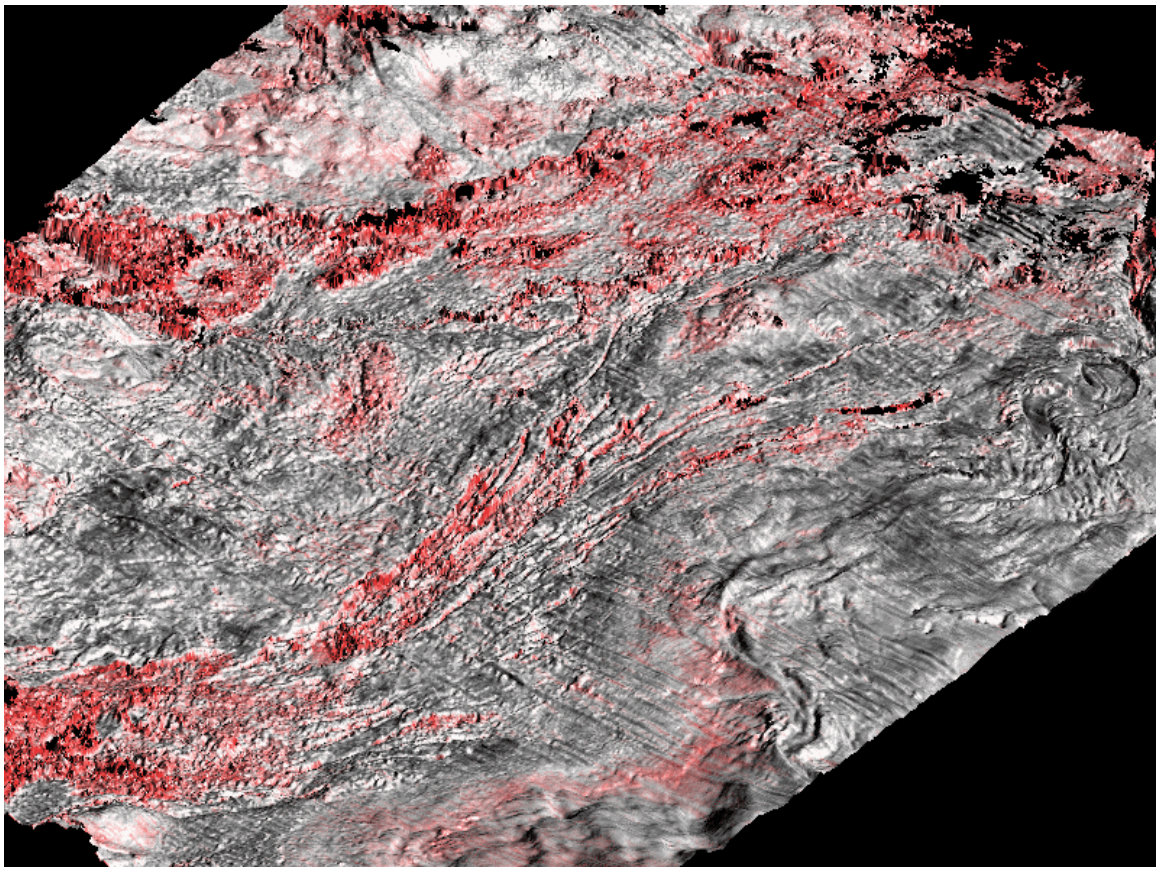

Figure 5: Stratigraphic interpretation of Deep water Gulf of Mexico data showing a Debris flow and channel levee system

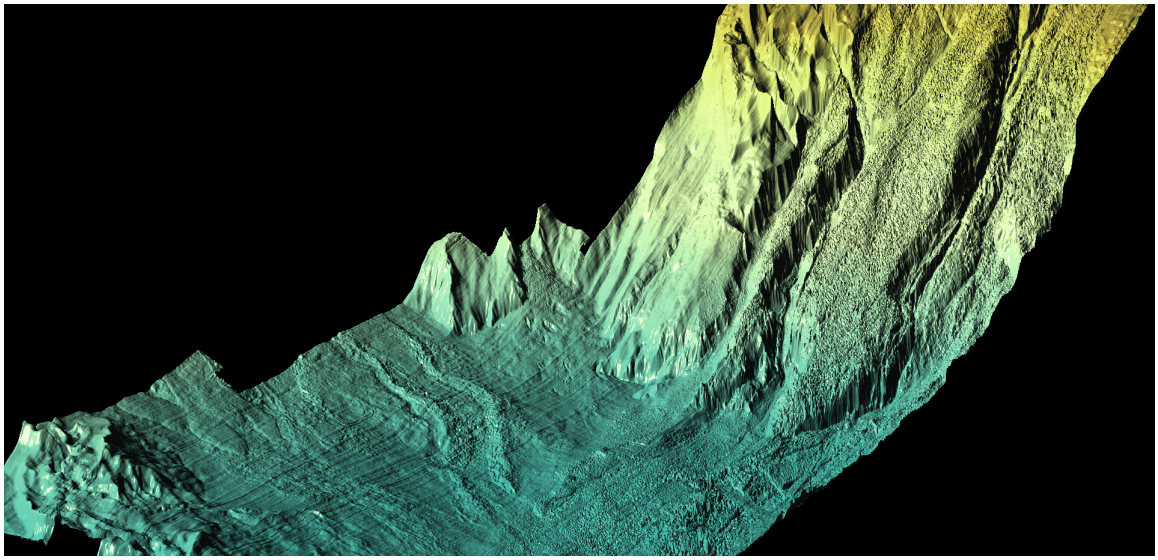

Figure 6: 3D image of surface exported from Stratamagic, enhanced using VoxelGeo showing fluvial deposits and channel levee system.