3D Flattened Space for Efficient Seismic Interpretation

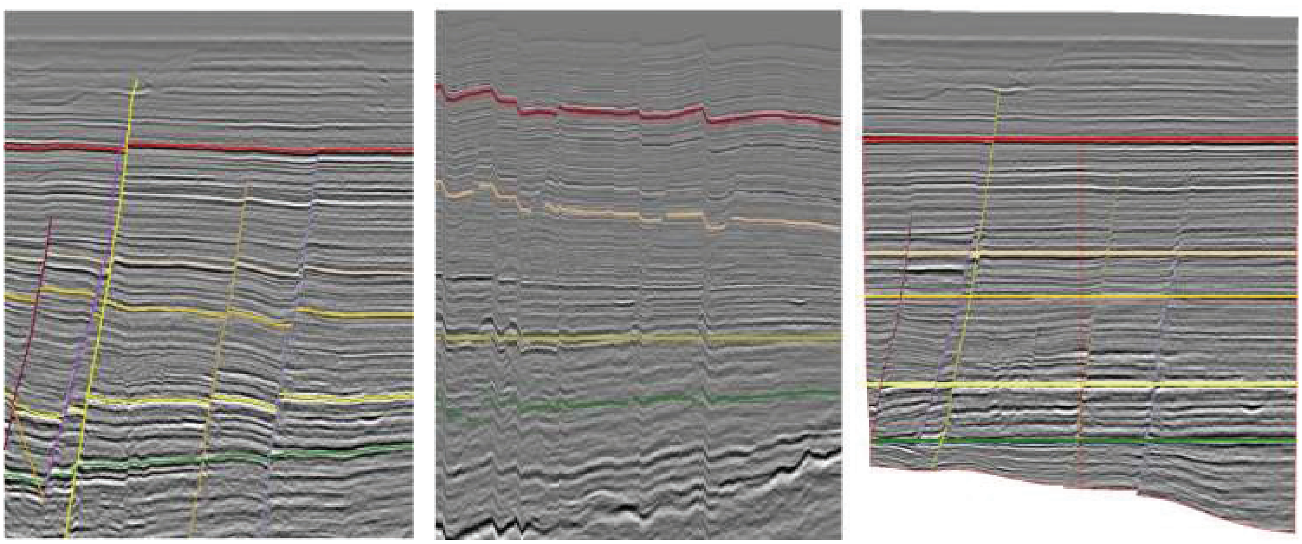
The Challenge

This independent oil company needed a better estimation of the trap size in order to assess the economic interest of the prospect. Due to known drilling risks in this area in the vicinity of faults, the client was also in need of better trap delineation in order to plan the safest well possible. The economic impact of this interpretation project was two-fold: driving the decision to drill or not, based on the economic viability of the prospect, and in the case of a go-ahead, mitigating potential drilling hazards that could cost millions of dollars of damage and losses.

The Assessment

Seismic flattening is a common interpretation technique used to remove structures such as folds or faults, to help the interpreter recognize geological features based on one horizon only. However, unconformities, as well as normal or reverse faults, are not handled correctly using this technique. Furthermore, the traces for which reference horizons have not been interpreted cannot be flattened.

Due to the high number of normal faults, the conventional flattening technique was not producing efficient outcomes for the client. The company decided to try 3D flattening instead.



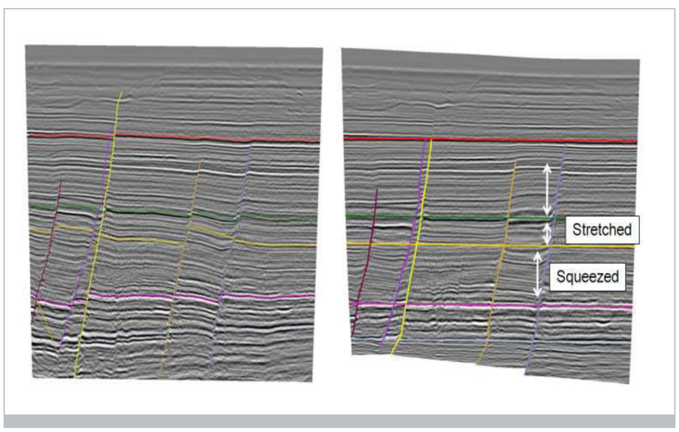
(a) Regular space *(b) Conventional 2D flattening* *(c) 3D flattened space*

The Solution

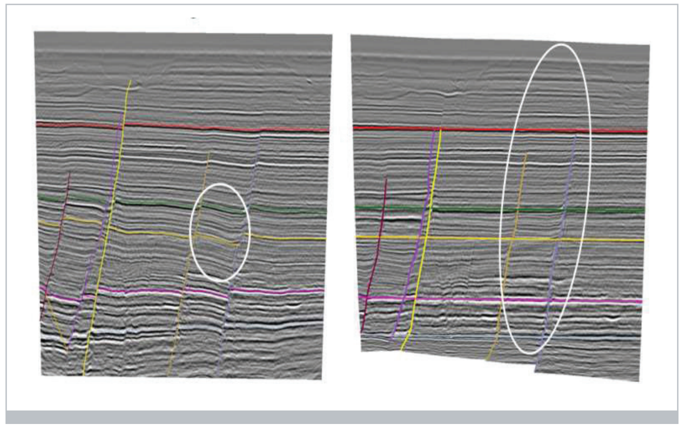
The client applied an iterative method using Paradigm™ SKUA™ to create a 3D flattened space based on a space/time framework and on the interpretation of the faults and a number of horizons. Any data such as seismic volumes, wells or horizon surfaces can be shown in this new space to QC and improve the interpretation.

The 3D flattening space workflow consisted of:

1. Interpretation of the faults and of the main stratigraphic events from the seismic data, using mostly automatic interpretation tools
2. Selection of the stratigraphic column, listing the statigraphic events and their relationships (conforming, unconforming)
3. Execution of the 3D UVT Transform™ parameterization of the volume, using an interpolation engine constrained by the faults, the interpreted events and the stratigraphic column. [This UVT transformation maps each (x,y,z) point in the regular space to a (u,v,t) point in the 3D flattened space.]
4. Projection of the seismic volume and the interpreted data into the flattened space using the UVT transform
5. Visualization, QC and re-interpretation in the flattened space



▲ Evidence of a wrong interpretation: In the 3D flattened space (right), the seismic is stretched and squeezed.



▲ After reinterpretation of the horizon in the block (left), the seismic in the 3D flattened space is now flat and continuous.

Other benefits of the process are:

- The 3D flattening works even when horizons are not fully interpreted over the whole survey area
- The process is relatively quick to complete, as only major events and unconformities are required
- Extraction of any intermediate conformable horizon is immediate by computing the corresponding iso-t surface
- Interactive QC and realtime updating of the model is achieved while reinterpreting

The Results

Applying the Paradigm SKUA UVT parameterization workflow resulted in a full 3D flattening of the data. This company rapidly changed the interpretation of the seismic data based on the 3D restoration. The new picks made the data look far more coherent. This provided validation of the revised seismic interpretation, leading to a more accurate estimation of potential reserves. The whole project took only a few days to complete, and the increased confidence in the prospect's merits as well as the better mitigation of drilling risks made the well proposal much more attractive to the operator and their partners.