Paradigm®

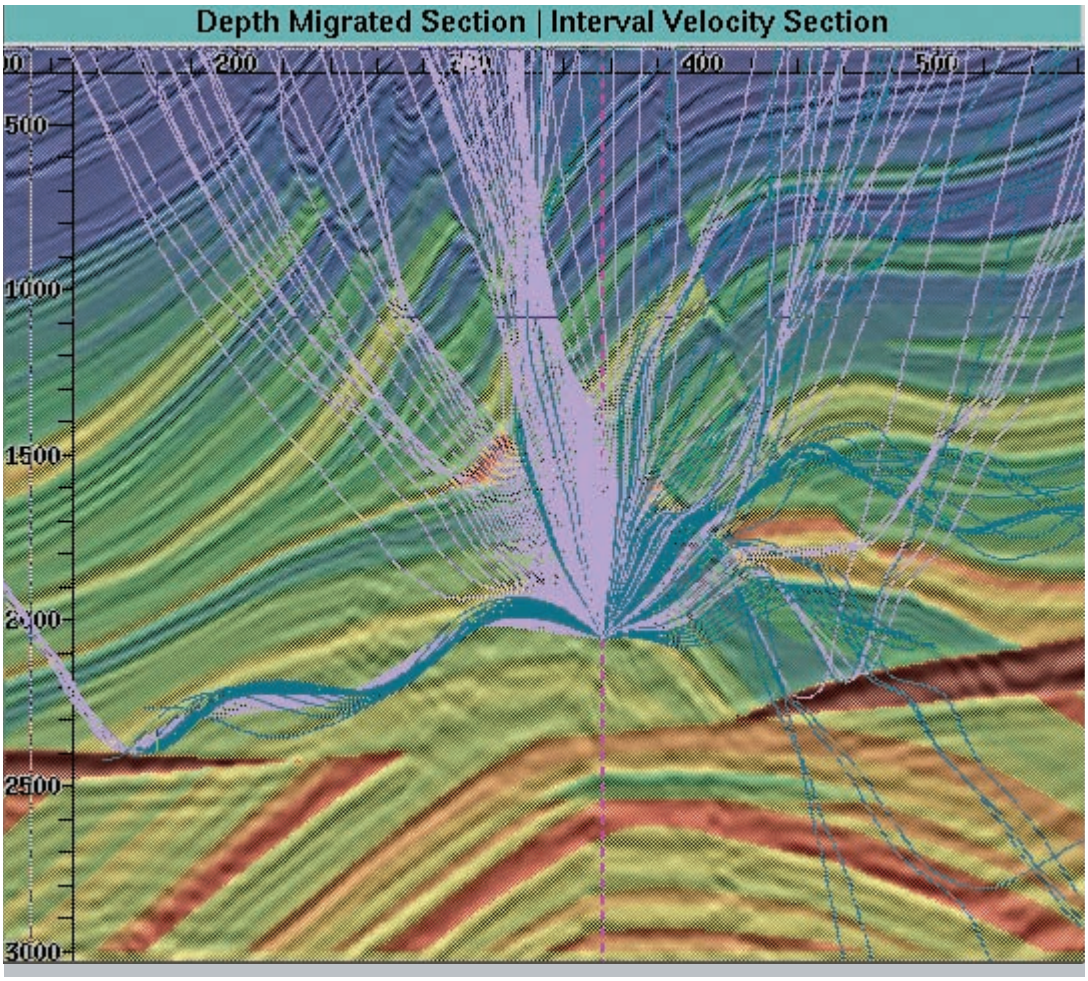
Improve Reservoir Imaging with Common Reflection Angle Migration

The Challenge

A small independent oil and gas company needed to improve the imaging of the reservoir to more clearly understand the geology prior to planning field development. Each well is worth millions of dollars and it is essential to have an accurate subsurface image to plan wells accordingly. Both time and budget considerations made it unrealistic to shoot new seismic. The decision was to maximize usage of the information within the current data set.

The Assessment

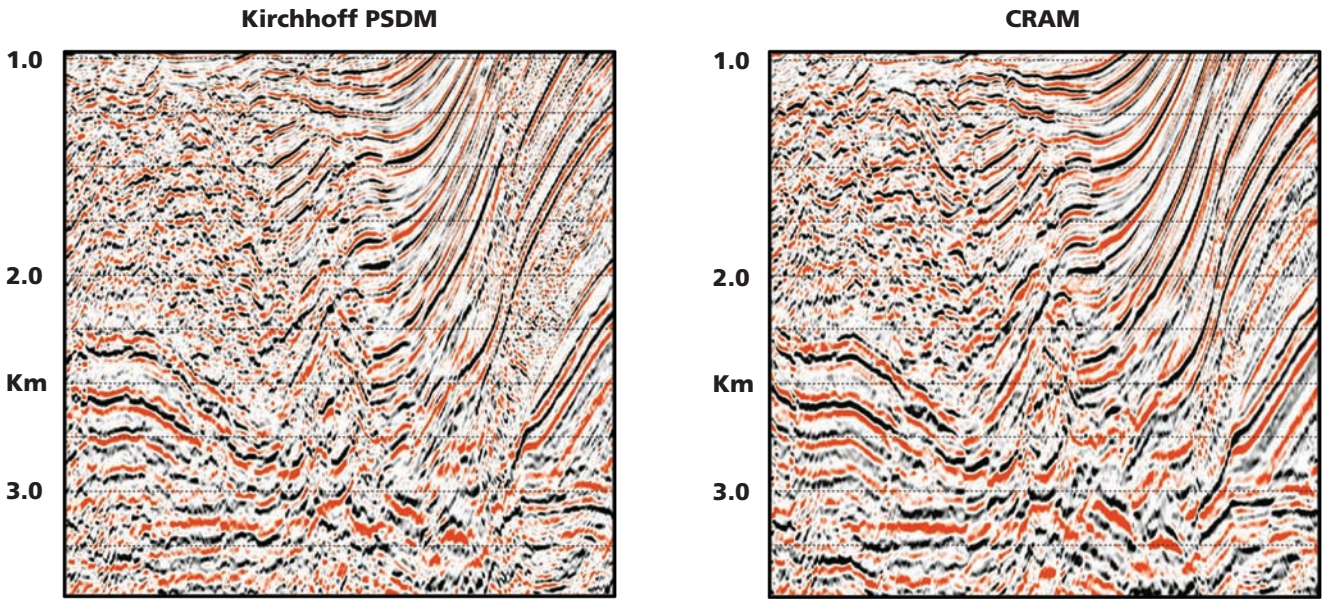
The reservoir is in a tilted fault block in the central North Sea and is structurally complex. The existing Kirchhoff migration could not come up with a good image in this area due to a complex overburden causing multiple ray path conflicts.



▲ Illumination gather.

The Solution

The Paradigm™ Common Reflection Angle Migration (CRAM), an anisotropic, multi-arrival solution, was used to provide a uniform illumination of the subsurface by performing a dense ray tracing from every image point up to the surface. The rays are traced in uniform angle increments and in all directions to ensure all arrivals are taken into account and all amplitudes are preserved. This bottom-up technique is performed in the local angle domain. A local reference system is used to map surface recorded seismic data to each image point. In this case, use was made of an existing velocity model.



CRAM is ideally suited to high-precision reservoir-level seismic imaging, since it focuses on the actual target's shape and reflectivity characteristics. Since the CRAM is an output driven process, the ability to control the target output areas was used effectively in testing and parameterization. The CRAM produced amplitude- and phase-preserved angle-dependent reflectivity gathers that are ideal as inputs to velocity analysis, in amplitude versus angle (AVA) inversion and other reservoir characterization workflows.

The Results

The customer got a much clearer image of the reservoir's geometry, including internal faulting patterns. The AVA information was a very valuable set of data for an improved understandin of the internal reservoir parameters.