Offshore Alaska: Prospect Maturation Techniques in Challenging Arctic Environments

Jaeger, Guenter [*1]; Homza, Thomas X.[2]; Rosenbladt, Robert L.[1]; Prusak, Deanne [3]; Hurst, Clive [3]; Buerkert, Thomas P.[4]
(1) Shell Exploration & Production Company, Houston, TX.
(2) Shell Exploration & Production Company, Anchorage, AK.
(3) Eni Petroleum, Houston, TX.
(4) Repsol E&P USA Inc., The Woodlands, TX.

Shell Exploration & Production Company is exploration phase operator for a joint venture with Eni Petroleum and Repsol E&P USA Inc. for acreage in the Beaufort Sea OCS just north of the giant Prudhoe Bay and Kuparuk River fields. Hydrocarbon prospects were identified in this area of the Beaufort Sea using 2D seismic data in the 70's and 80's; some drilling resulted in successes (e.g. Tern Island, Seal Island) while others were "giant" failures (e.g. Mukluk). In light of these mixed results, the partnership agreed that it was necessary to apply a suite of modern geophysical techniques for maturing leads and prospects. The first improvement included the acquisition of 3D-data over identified promising areas.

Given the shallow water, nearshore location, two options for 3D data acquisition were identified: a) on-ice acquisition on land-fast, floating ice and b) conventional marine streamer acquisition. Option (a) was deemed more desirable due to environmental and stakeholder considerations. To ensure that the on-ice option was technically feasible, a test survey was acquired and processed. Results were encouraging, but ice conditions did not allow commencing operations to acquire the full survey. Thus, a conventional streamer dataset was acquired instead.

Planning and execution for a marine summer 3D acquisition program in the Beaufort Sea required addressing a number of constraints: 1) Arctic weather & ice conditions, 2) concurrent nearby 3D-OBC acquisition activity, and 3) avoidance of potential whaling activities in the area. Managing these complexities was an integral part of our program. During 3D acquisition, approaching sea-ice forced a decision to either a) continue with a regular 3D geometry over only part of the prospective area or b) enter a 2D-swath acquisition mode with the aspiration of covering the entire planned area. In light of the overall venture timeline and given relatively "benign" overburden geology, the JV partners decided on the latter; with the intent to conduct full 3D processing using pre/post migration interpolation. Initial results on a Post-stack interpolation of a Fastrack cube appeared promising. Final pre-stack interpolated 3D datasets showed that this approach, given these specific subsurface and acquisition geometries, produced acceptable results.

PreSTM processing and subsequent interpretation of that dataset, however, revealed that the subsurface velocity field was not so "benign": The presence of Upper Cretaceous submarine slides as well as velocity anisotropy in the Lower Brookian distorted the seismic image. The partnership thus decided to conduct an anisotropic PreSDM to overcome time processing limitations. Results show a marked improvement in

the resolution of the velocity field as well as the overall seismic image.

Examples of these geophysical activities will be shown; the presented approach might be applicable in similar operations with limited windows of opportunity.