

Adding Value with Seismic, The Aspenleaf Energy Story

By J. Douglas Uffen*, Brian Fischer

Reflection Peak Enterprises Limited, Aspenleaf Energy Limited

Overview

The Aspenleaf Energy Limited seismic story has been a journey of continuous learning, discovery and achievement over a 10-year period using a collaborative and integrated multi-disciplinary team approach. The interpretation and integration of seismic data has proven value adding, having enhanced the understanding of the subsurface interpretations for all three (3) core properties. The seismic contribution varied for each core property but what is consistent is the appreciation for what seismic data has brought to the table both in knowledge and understanding, but also in terms of hard monetary value.

Swan Hills

Aspenleaf's Swan Hills asset produces hydrocarbons from the Swan Hills platform. Prior familiarity with the asset focused on mapping the platform margin edge and providing insight as to what to try next with the seismic data interpretation. Before any Aspenleaf drilling, the top platform seismic horizon pick was converted to depth and revealed a monocline in the middle of the producing field that was previously unrecognized. With this structure unaccounted for, earlier well paths drilled across stratigraphy with the resultant reservoir variability along the wellbore being attributed to lateral, rather than vertical facies changes. Once detailed structural elements were incorporated into drilling plans, it became clear the lateral facies variability was markedly less than the original interpretations. This was a critical input into Aspenleaf's waterflood development planning. Subsequent dynamic data provided further confidence to the lateral extent of the reservoir facies and has resulted in ongoing expansion of the waterflood area.

Efforts then shifted back to defining the platform edge, incorporating a novel geologic interpretation of a low angle wedge rather than a traditional reef margin. Forward modeling efforts identified seismic tuning resolution issues. Despite these concerns, attempts to define the reef edge were conducted using isochronal methods. Further refinement suggested that not only the platform edge might be predictable but ancillary edges for the Middle platform, Upper platform and Upper+ platform edges might be possible. Isochronal cut-off rules were developed but were found to be too inconsistent across the area to be trustworthy. In the end, an isopach from the Watt Mountain depth map to the Top Swan Hills platform depth map, accounting for the 7m of the Slave Point and Fort Vermillion section, was integrated into the geologically defined isopach's of the main Swan Hills Platform cycles to determine the thickness and extent of each of these units. Using this resultant platform isopach map, twelve (12) wells have been drilled along the edge, adding 2714 bbls/d IP 90 production and 6 million bbls of Total Proved and Probable reserves as of the end of 2023.

Leduc-Woodbend

Aspenleaf acquired the Leduc-Woodbend asset in 2018. As the Nisku Formation is the primary target, a depth map was created at the top of this interval and has been updated with ensuing drilling operations to aid in well placement. In doing this, deep seated faulting related to the Snowbird Tectonic Zone was recognised, mapped and incorporated with the geologic and

reservoir engineering data to derive an integrated interpretation of the field which includes better understanding of tectonism, sedimentation and diagenesis. This helped define barriers and baffles which compartmentalize the field, explain the position and shape of the underlying Leduc Reef, the edge of the Cooking Lake Formation and identify the Leduc Formation spill point to Acheson. Nisku amplitude mapping, although not definitive, insinuated areas of reduced porosity. Since acquisition, Aspenleaf has grown production from ~10,600boe/d to roughly ~15,000boe/d as of year end 2023 and has added ~25 million BOE of Total Proved and Probable reserves.

Twining

Aspenleaf acquired the Twining asset in 2020. This is an unusual accumulation given that it is comprised of over-pressured sweet oil, up-dip of under-pressured very sour gas all trapped within the dolomites of the Crossfield Member of the Wabamun Group. Well placement was going to be critical to success as wellbore stability was a known issue. From the onset, interpreting the Crossfield horizon proved to be a difficult task as the acoustic impedance contrast between it and the Upper Stettler was so slight. VSP transfer functions were investigated to enhance frequency content. Ultimately the data was reprocessed and near offset stacks were used to interpret the zone of interest. Although improved from the initial processed dataset, the resultant time horizon was too “jittery” given the thin target zone and the importance of wellbore placement, so the Wabamun horizon was converted to depth with a geological isopach map added to it. The resultant depth map was still too “jittery” so the more stable Upper Zero Crossing time horizon of the Wabamun was used to convert to geological Crossfield depth values subsea. While breaking the technical rules associated with depth conversion, the map proved effective in placing numerous horizontal wells. Later, the addition of wells with Viking penetrations, extrapolated to the Crossfield based upon regional isopach values, permitted the integration of shallower well control to add further depth control points. Interpretation of the deeper section has identified strike and oblique-slip faults within the project area. Current geologic interpretation is that these deep-seated faults, episodically active through the Wabamun time, acted as conduits for the hot fluids that altered the diagenesis of the reservoir in some locales. Aspenleaf has increased production from ~1,000boe/d to over ~6,000boe/d as of year end 2023 and has added 17.2 million BOE of Total Proved and Probable reserves.

Conclusion

Geophysics has been an integral part of Aspenleaf’s success throughout its history. Seismic data and innovative interpretive techniques have directly and indirectly added significant value to Aspenleaf’s success story by improving the subsurface model, thus enhancing predictability.

