

Geophysical contributions to the development strategy for the Notikewin Formation in the Alberta Deep Basin

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Abstract

Shell's Deep Basin East gas field development is exploiting an approximately 700m thick package of clastics and sandstones deposited in a mixture of terrestrial and marine depositional environments in the Cretaceous aged foreland basin of the Rocky Mountain Cordillera. Diagenesis has rendered the sands with small porosities and permeabilities resulting in a basin centered gas system with hydrocarbons trapped by up dip water. Historically vertical wells have been drilled to access multiple zones of pay. These zones are then hydraulically fractured to provide the necessary stimulation to yield economic co-mingled production.

While co-mingled flow in vertical wells from 10 sandstone prone formations results in lognormally distributed well performance, it can be shown that geo-targeting higher quality reservoir can result in superior well performance. For example, within the Shell acreage where the Notikewin Formation is typified by a mixture of coastal plain and fluvial sand deposits, 3D seismic attributes extracted from the Notikewin show sinuous anomaly trends. These trends correlate to higher proportions of net sand and porosity and are interpreted as stacked fluvial channel belts. In areas of higher seismic data quality post-stack attributes such as spectral waveform classifier (Li et al., 2010) can be directly correlated to reservoir properties such as net sand and Φ_{iH} . Inflow profile data from vertical wells shows that the Notikewin Formation delivers high gas flow rates in these fairways of stacked fluvial sands. By contrast, lower flow rates are observed from the Notikewin when the well only penetrates thin coastal plain sands and silts. In areas of the field where other formations are typically not high contributors to gas production total well performance is seen to be markedly higher if located within a Notikewin channel fairway.

In order to maximize field economics, the development team is appraising the potential uplift from drilling reservoir sweet spots horizontally. Given the gas deliverability in vertical wells of the seismically mappable Notikewin channel sands, these sands are an obvious choice for testing horizontal well development. 3D volume attributes as well as information derived from microseismic monitoring of vertical well completions is used to optimize well placement and completions.

References

Li, X., Jong, P., Sylvester, Z., Germs, H., Dwan, F., Jackson, A., Cook, J., Gesbert, S., Feng, C., and Griffith, D. (2010) Spectral waveform classifier: method and examples. SEG Technical Program Expanded Abstracts 2010: pp. 1398-1402.