

The Blackfoot broad-band 3-C seismic survey: Introduction

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ABSTRACT

A set of 2-D seismic lines were acquired over the Blackfoot field near Strathmore, Alberta. These lines included a variety of geophones (2-C 2 Hz, 3-C 4.5 Hz, 3-C 10 Hz, vertical 10 Hz strings) deployed across a line of 4 km. The source was a 6 kg charge of dynamite at 18 m depth. The survey was undertaken as a geophone comparison test, to image a glauconitic sandstone reservoir, and to help design parameters for a subsequent 3C-3D survey. Preliminary P-P and P-S sections both show the primary target (the glauconitic sand) and a deeper area of interest, the Devonian carbonates. Sections resulting from the different geophones appear to be quite similar. The glauconitic sand channel is also evident on both P-P and P-S sections. Common offset panels and decimated sections were very helpful in designing the follow-on 3C-3D survey.

OVERVIEW OF OBJECTIVES

The Blackfoot broad-band 3-C seismic survey was acquired July 1 - 10, 1995 by the CREWES Project over the Blackfoot field near Strathmore, Alberta. The survey had a number of goals. They were to:

- i) acquire broad-band seismic data from 0.5 Hz to 100 Hz,
- ii) observe any differences between arrays of vertical geophones and single elements,
- iii) analyse whether the low-end frequencies improve the processing, final time sections, or inversions of P-P and P-S data,
- iv) observe whether P-S data can help elucidate the sand channels,
- v) differentiate seismically between sand, shale, and shale plug lithologies encased in regional silts,
- vi) analyse the elastic response of the Devonian carbonate section,
- vii) acquire data for detailed design of a 3C-3D seismic survey over the same area.

The data have been processed by a number of groups and analysis is underway. The following chapters on the Blackfoot data show preliminary results of this analysis.

GEOLOGY

The Blackfoot oil pool is in a fluvial/estuarine glauconite sand of the Lower Cretaceous. It is located in Township 23, Range 23W4 about 8 miles SE of Strathmore, Alberta. Sands of this type comprise some of the most prolific oil and gas reservoirs in S. Alberta (Syhlonyk, 1995). They are at a depth of about 1550m and can have thicknesses up to 43m. Their importance and potential (and proximity to Calgary), make them ideal reservoirs to study. They also are somewhat difficult to see on conventional P-wave seismic. Initial modeling from well logs indicates that the P-S response may be significantly different than the P-P response, thus the promise of using both surveys to achieve a better result. The pool contains a number of wells with suites of well logs. Several VSP surveys also are nearby.

SEISMIC SURVEY

The survey was designed to test the above objectives. As such there were a number of geophones used. The 2 Hz geophones were deployed to capture the low frequencies, especially in the range of 0.5 - 10 Hz. These 2 Hz geophones are large and heavy cylinders and thus somewhat impractical for production seismic work. They were workable for this experiment though. The 4.5 Hz phones were 3-C phones that could be practically deployed. The 10 Hz 3-C phones are standard industry receivers. A six-geophone string of vertical phones provided comparison and control. The receiver interval was 20m and shots were taken every half station (20m). The ARAM-24 recording system was used as it could record down to less than 1 Hz. There were 1660 channels recorded. Surveying conditions were complicated by severe rainstorms and agricultural usage. Further details of the survey are discussed in later papers.

ANALYSIS AND INTERPRETATION

The processing of the data has been undertaken by a number of workers as outlined in subsequent chapters. Sensor Geophysical Ltd. of Calgary and Pulsonic Geophysical of Calgary have also processed the data. Further processing and interpretation of the data will follow in the next months.

REFERENCES

Syhlonyk, G. E., 1995, Proposal for a 3C-3D seismic survey over the Blackfoot field, Strathmore, Alberta: Personal communication.