Review of Pike's Peak project

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ABSTRACT

The AOSTRA research project at the University of Calgary has many facets, including high-resolution vibroseis, AVO, surface wave suppression and reservoir monitoring. The project review of May 16, 2000 included talks that demonstrated considerable progress in all of these areas by the project investigators.

INTRODUCTION

The AOSTRA project on seismic technology for heavy oil development has centered on Husky's Pike's Peak oil field just east of Lloydminster. At Pike's Peak, the target of interest is the Waseca formation, which is a high-porosity oil sand channel at a depth of approximately 500m. The rock properties of the oil field are described in a report from Core Laboratories and reports by Hedlin (2000) and Stewart (private communication).

Enhanced oil recovery (EOR) in the field has been made possible through steam injection. In order to monitor steam fronts in the EOR process, two sets of measurements are devised. Rock property measurements on cores are used to measure the effect of temperature and pressure on seismic velocity. Once a velocity-temperature relationship has been established, repeated seismic surveys can be used to monitor the EOR process. Velocity changes due to steaming should reveal themselves through amplitude and traveltime differences in successive seismic surveys.

THEORY

The seismic experiments at Pike's Peak were unique and interesting in many ways. The survey was essentially a "five component" survey. The acquisition involved a 3C survey for individual phones at 10 m group spacing. There was a conventional survey of geophone groups at 20 m spacing. In addition to this, there were microphones placed at 20m spacing for recording the air-wave blast for the purposes of surface wave attenuation. Discussions of acquisition and processing are presented by Hoffe et al. (2000). The use of microphone data to suppress surface waves is given by Dey et al. (2000).

In these vibroseis experiments, the sweep was between 8-150 Hz with a duration of 16 s. Two vibrators were used at a spacing of 20m. The uncorrelated data were recorded for the purposes of deconvolution. In this project review, Brittle et al.(2000) showed interesting comparisons between cross-correlation and deconvolution as a means of obtaining high-resolution seismic data.

One of the major aspects of the project is the investigation of amplitude variation with offset (AVO). Depending on the rock properties and their change with time, AVO could be a diagnostic tool for reservoir monitoring. The investigation of rock properties and the effect of temperature change on amplitudes is investigated by Downton (2000). The effect of reservoir changes on impedance is investigated by Watson and Lines (2000).

CONCLUSIONS

The last 6 months of the Pike's Peak project have shown considerable advances in all areas of the seismic monitoring project. The relevant papers included in the 2000 CREWES Research Report provide a good description of this research.

REFERENCES

Brittle, K., Lines, L.R., and Dey, A.K., 2000, Vibroseis deconvolution: A synthetic comparison of cross-correlation and frequency sweep deconvolution: AOSTRA contract 1296, report #3.

Dey, A.K., Stewart, R.R., and Lines, L.R., 2000, Towards a dual sensor for active noise suppression on land seismic data: AOSTRA contract 1296, report #3.

Downton, J., Preliminary results of AVO analysis at Pikes Peak: AOSTRA contract 1296, report #3.

Hedlin, K., 2000, Rock Properties and Attenuation at Pikes Peak: AOSTRA contract 1296, report #3.

Hoffe, B., Bertram, M., Bland, H.C., Gallant, E., and Mewhort, L.E., 2000, Acquisition and processing of the Pikes Peak 3C-2D seismic survey, AOSTRA contract 1296, report #3.

Watson, I.A., and Lines, L.R., 2000, Seismic inversion at Pikes Peak, Saskatchewan, AOSTRA contract 1296, report #3.