

Author(s) Bob A. Hardage  
Title USING DRILL BIT VIBRATIONS AS A  
SEISMIC ENERGY SOURCE FOR SALT  
PROXIMITY AND INVERSE VSP IMAGING

ABSTRACT

Vertical Seismic Profiling (VSP) is often used to provide high resolution seismic images near a wellbore. A new borehole seismic technique, the TOMEX survey, uses the vibrations produced by a drill bit as a downhole seismic energy source to produce inverse VSP and salt proximity data. No downhole instrumentation is required to acquire the data, and the data recording does not interfere with or delay the drilling process. Hence, there is no loss of rig time in performing the survey. These characteristics offer a method to acquire SWD (seismic-while-drilling) borehole seismic surveys. In addition, 3-D imaging around a well can be obtained at significant savings compared to conventional offset VSP imaging.

The continuous signals generated by the bit during drilling are monitored with a reference sensor attached to the top of the drillstring, and the reference sensor signals are crosscorrelated with signals from surface-positioned geophones to produce data which can be used for inverse VSP imaging, predicting ahead of the bit, or for performing salt proximity analyses. Deconvolution and time shifts are used to remove the effects of recording the source reference trace at a location that is a considerable distance from the source. Results from tests demonstrate that for rotary cone drill bits, these processed drill-bit source data are equivalent to conventional forward VSP data.