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Vertical Seismic Profiles: An Interpretational Aid

The technique of vertical seismic profiling (VSP) is coming into vogue in the oil industry, and is currently undergoing evaluation by both research and operations groups. The reasons for this popularity are several, and they are probably valid ones. First, the VSP technique is relatively simple, being an extension of the check-shot or velocity surveying method: a surface source located near a borehole is excited and the resulting waves are recorded downhole by wall-clamped geophones. The main differences between the check-shot method and the VSP method are that the VSP recording spacing is shorter, usually 50 or 100 ft, and the recording time is for a few seconds after the first break, rather than the duration required just to record the first break. Second, there are several useful applications of VSP data, three of which are realizable now: (1) VSP data provide an accurate measure of depths to reflectors seen in surface seismic data, (2) VSP data provide recognition of multiples and more successful deconvolution operators, and (3) VSP data provide accurate interval velocities which are determined in the frequency band of seismic data. The applications of the near future (hopefully) are to: (1) provide shear-wave velocities, (2) provide the means to study attenuation, (3) provide high-resolution structural and stratigraphic information within a few hundred feet of a well, and (4) to provide prediction-ahead-of-the-bit capability.

A VSP data set acquired in the Overthrust Belt illustrates some of the power, and some of the problems, inherent in the use of the method. This data set points out the necessity of forward modeling in order to interpret the VSP data.