SEISMIC REFLECTION

Applications

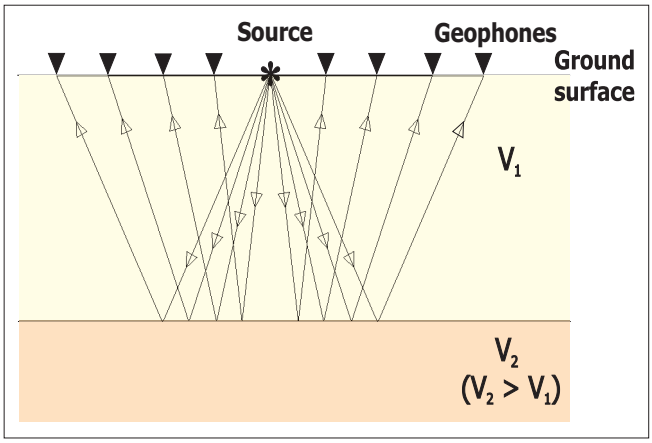
- ☑ *Stratigraphic mapping*
- ☑ *Geological mapping*
- ☑ *Estimation of depth to bedrock*

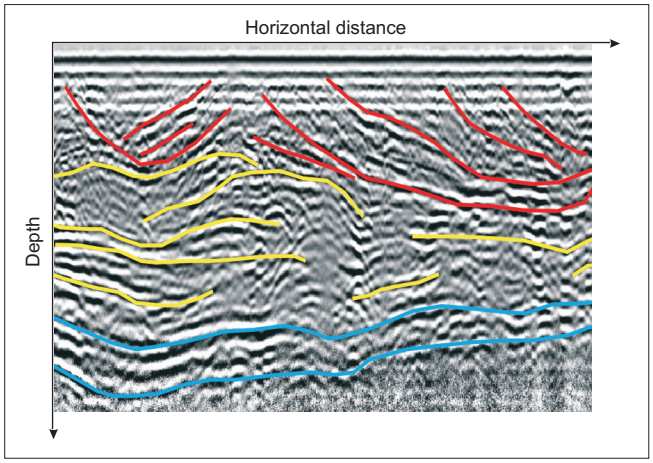
Basic Theory

Elastic energy injected into the ground by an impulse or vibrating source will propagate through the ground as elastic or seismic waves. Where a wave encounters a contrast in acoustic impedance (determined by the elastic properties of a material and its density) a proportion of the wave energy will be reflected. Recordings of the seismic waves reflected back to the surface can then be processed to construct an image representative of the subsurface.

Any geological boundary can represent a contrast that would generate a reflection. As such the technique can provide detailed information on the geometry of sedimentary sequences, structural faults, igneous intrusions and evaporite deposits. Dependent upon the nature of the data additional information can be derived from the seismic velocity absorption or anisotropy of individual units.

The technique is likely to be useful in a wide range of geological environments because of its ability to produce an image of the subsurface that can be tied directly to a geological model. Details of individual geological units can be traced across the survey volume, and structural features can also be mapped. In addition, advanced processing can be undertaken to obtain other characteristics of the seismic waves that can be linked to specific physical properties of the rock mass such as fracture density and orientation, porosity and rock mass strength. These wave characteristics are called “attributes”, and examples of seismic attributes include the amplitude, frequency or phase of the seismic wave





The ability of a seismic data set to image a geological feature is largely a function of the frequency content of the seismic data, with a higher frequency content leading to greater resolution. The frequency content of a seismic data set is controlled by the seismic source type. Large explosive charges have higher energy low frequencies than smaller explosives. Frequency sweep sources such as Vibroseis land trucks or tuned air guns rely on the control provided by a known source wave containing a range of frequencies and the frequency content will depend on the system and configuration deployed.

Higher frequencies provide higher resolution, but are more quickly absorbed by the earth and so have limited depth penetration. The theoretical resolution of features within a data set is equal to one quarter of the wavelength of the seismic signal. In practice other factors affect the signal to noise ratio and reduce the resolution achieved.

For further information, visit us at www.rsk.co.uk or contact:
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