SEISMIC
EXPLORATION
INC.

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Alluvium Depth Determination (ADD)

Seismic Exploration Inc. (SEI) has developed a new seismic technique applicable to mining exploration. This is a passive seismic method that measures resonant effects of low velocity alluvial layers. From analysis of this data, alluvium depths can be determined by assigning a velocity to the overburden material. This provides valuable information when used independently or to complement gravity surveys.

The source of energy measured is a compressional form of seismic energy termed microtremors. Microtremors are vertically traveling P-waves generated deep within the earth. Although the generating mechanism for this energy is not well understood, it is measurable by statistically analyzing large quantities of seismic noise data. Shell Oil has in the time domain cross correlated about four hours of these microtremors to produce seismic profiles that closely approximate active seismic sections for the same locations.

Studies in the frequency domain (Katz, 1976) have correlated microtremor spectral peaks to resonant effects of low velocity surface layers. The frequency of these peaks is related to the vertical travel time in the layer. Thus, a body wave incident at the base of a shallow low velocity surface layer is multiply reflected at the top and bottom acoustic impedance interfaces. Wave conversion also takes place. These processes combine to cause the layer to enhance selected frequency components related to the natural period of the layered sequence.

Basic principles of interpretation incorporate crustal inversion techniques which make possible the determination of depth and velocity contrast beneath the station. Resonant effects are additive in the frequency domain. This means spectra of large quantities of data can be stacked to enhance features not detectable from a single power spectra. Results from this method have been confirmed by bore holes, gravity, and resistivity surveys.

This is a cost effective tool with applications in uranium and coal exploration, mining economics, and structural engineering. A final report prepared for the customer includes:

- Contour maps of overburden thickness
- Cross sections
- Fault map
- Written text (documents data collection, analysis, and geophysical interpretation)

Reference: Katz, L. J. Microtremor Analysis of Local Geological Conditions, Bull. Seismological Soc. Am., V. 66, No. 2, 1976, pp. 45-60.

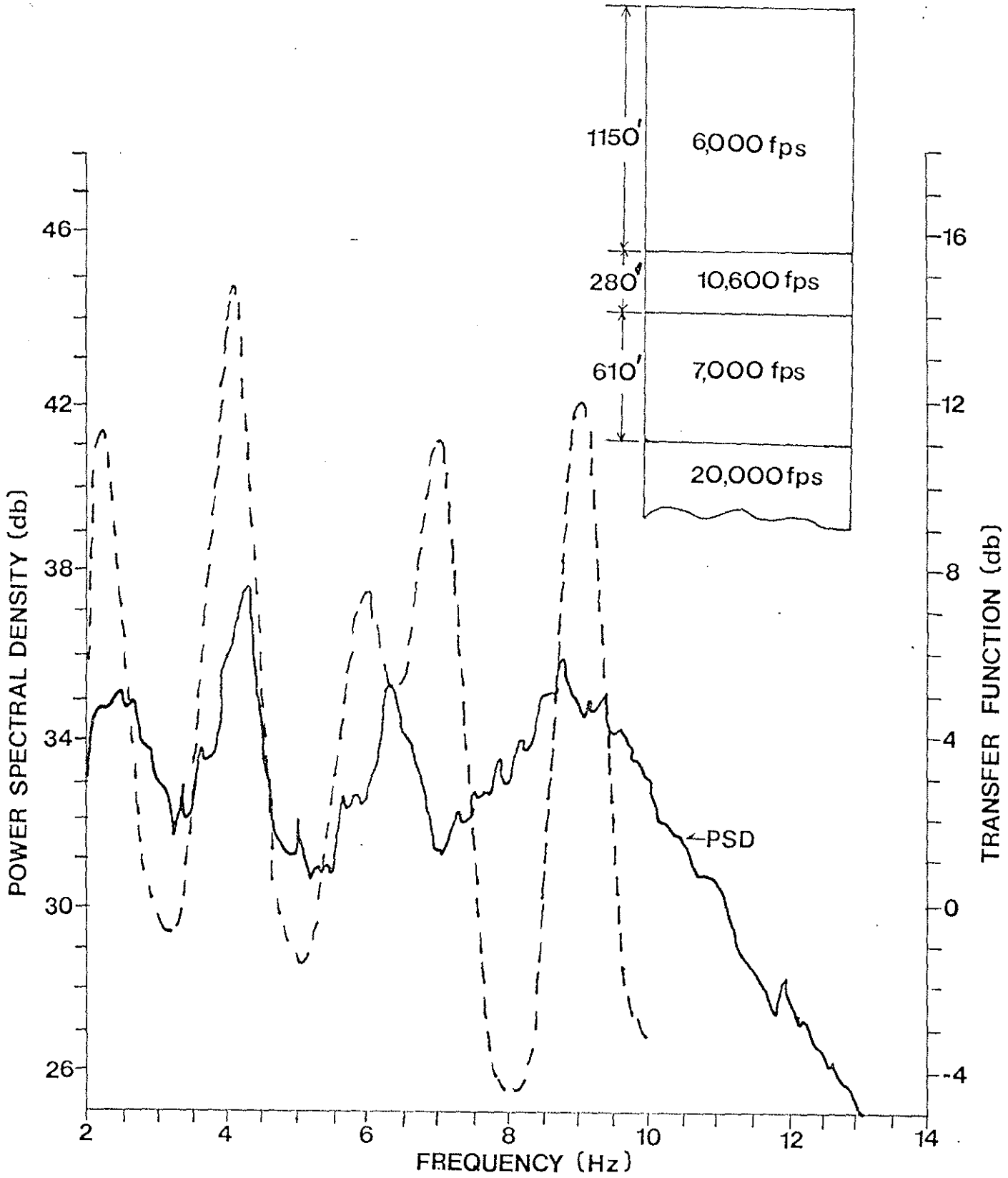

Figure 1. Solid line is the recorded Power Spectral Density, dashed line is crustal inversion model. Geological interpretation is shown in upper right-hand corner.